A

SYSTEM

OF

PRACTICAL THERAPEUTICS.

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VOL. II.

FEVERS—DISEASES OF THE RESPIRATORY SYSTEM, CIRCULATORY SYSTEM, AND HÆMATOPOIETIC SYSTEM—DISEASES OF THE DIGESTIVE SYSTEM.

WITH ILLUSTRATIONS.

PHILADELPHIA:

LEA BROTHERS & CO.

1892.

WESTCOTT & THOMSON
Stereotypers, Philadelphia.

WILLIAM J. DORNAN,
Printer, Philadelphia.

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SYPHILIS.

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Syphilis is a chronic infectious disease affecting the whole organism, and characterized by the development of an inflammatory process of a low grade, and by the formation of a low form of cell-growth called granulation tissue. Though it is claimed that syphilis depends essentially upon a micro-organism for its virulence, and though its analogy with other chronic infecting granulation-tissue diseases, notably leprosy, supports that view, we are not to-day in the possession of a definite knowledge of any microbe which has been shown either by circumstantial evidence or experimental inoculation to be capable of producing the disease.

There are two well-marked forms of syphilis—the acquired disease, obtained by contact with a previous syphilitic; and the hereditary form, in which the infection has been transmitted from one or both parents to the offspring.

Acquired syphilis always begins with the development of a local lesion called the chancre, the hard or Hunterian chancre, the infecting chancre or sclerosis, the initial lesion, the primitive neoplasm, and the primary syphilitic ulcer. This in due time is followed by general manifestations of varied character, extent, and severity. Thus, for purposes of description we speak of a primary period of syphilis, which includes the interval between the infecting coitus and the appearance of the chancre, and the further lapse of time until the evolution of secondary manifestations. In general, this primary stage of the disease may be said to occupy a period of from fifty to eighty days. In the primary stage of syphilis the only objective phenomena are the chancre and the resulting enlargement and swelling of the lymphatics and ganglia anatomically connected with the infected area. By some the primary stage of syphilis is looked upon as its period of local infection, while with the evolution of the secondary stage the disease is said to become constitutional. The truth is, that infection of the organism begins as soon as the morbid matter is deposited upon it, and that involvement of the system goes on slowly until the climax is reached with the onset of the secondary period with its generalized lesions. We are not cognizant of the manifold and intricate morbid processes which form the culmination of the syphilitic infection of the organ-

ism, as shown in the onset, invasion, or explosion of the secondary period. Clinical facts and therapeutic deductions and teachings seem to warrant the view that by slow degrees a crisis has been reached; that the infection of the economy is now complete; and that we have at last a recognizable morbid constitutional condition. The primary period, therefore, is sharply limited. The secondary period covers a longer or shorter lapse of time, and although attempts have been made to state it with tolerable accuracy, it may be said that to-day no absolute chronological data can be laid down. The secondary period may last a few months or a year or more, during which the lesions are of the mild and more superficial character.

The onset of the tertiary period is correspondingly irregular; it may be early and it may be late, and it may never appear. From a therapeutic point of view, we thus being unable to draw sharp lines of demarcation between the secondary and tertiary stages, it is well in a general way to speak of secondary lesions as being peculiar to the first year or year and a half of the disease, and to consider the general diathetic condition of the time beyond that, and the lesion and symptoms concomitant to it, as evidences of a tertiary period. But, as we shall see later on, this division, which will answer well for very many cases, will be found to have many exceptions. As a broad generalization it may be safely stated that there is a well-marked line of treatment peculiar to the first year of syphilis, and that the indications for specific medication for periods beyond that date are well understood and can be quite readily attained. By this way of reasoning we advance toward simplicity.

In undertaking the treatment of acquired syphilis we are confronted with the following problems: First, can we abort or suppress the disease in the early stage by the destruction or excision of its initial lesions? Second, can we by a general preventive treatment suppress, abort, or favorably attenuate or modify it? If these procedures are found impossible, ineffective, or inexpedient, we come to a further question: Third, shall we begin general systemic treatment as soon as a positive diagnosis of syphilitic infection is made, or shall we wait until the evolution of the secondary period proves to us that the climax has at last been reached and that the whole organism is involved? Having settled these problems, we shall then be prepared, Fourth, to consider the question of the best methods and the best agents for the treatment of the disease, and, Fifth, to determine how long it is necessary to continue treatment.

Abortive Treatment.

Excision of Chancres.—Let us now consider the first question: Can we abort or suppress the disease by the destruction or excision

of its initial lesion? The idea of preventing syphilis by the destruction of the chancre is a very old one, dating as far back as the end of the fifteenth century. It was brought into prominence by the writings of Bell and Hunter toward the end of the last century. These famous surgeons taught that the chancre was always local, and that general infection did not occur immediately, but that it followed as an accident consecutive to the chancre. In spite of such strong statements, which by implication recommended the excision of chancre as a cure for syphilis, no clinical evidence of its use early in this century is at hand. The era of this prophylactic treatment may be said to begin with the publication of a paper by Hüter[1] in 1867, which, though sadly incomplete in many details, claimed the cure of two cases of syphilis out of seven in which the chancre had been excised. This paper may be said to have led the way to the generalization of excision of chancre as a means of attenuating, emasculating, delaying, suppressing, or aborting syphilis in its early stage. The theory of its action may be briefly stated to be based upon the supposed local character of the initial lesion which was thought to exist for a short time after its appearance. The opposite theory, of the immediate infection of the system, presupposed the entry of the virus through the lymphatic system into the general circulation, and its return to the point of infection, where it underwent a slow process of germination, and then again became generalized. This view was not supported by the facts offered by the evolution of syphilis nor by the clinical features of the hard chancre itself; therefore, this theory failing, the doctrine of early localization was quite generally accepted.

The opinions very generally held by advanced students and authorities in syphilis as to what takes place in the early stages of infection may be concisely stated as follows: That the virus is localized at its point of entry, and that the first stage of syphilis, or rather its first period of incubation (which means the interval between the date of the infecting contamination and the appearance of the chancre), is occupied by the processes which go toward the development of the chancre, and that this lesion is then the sole expression of the disease. The virus is then supposed to be limited to the chancre for some time—let us say from one to eight or ten days—and in this period annihilation of the disease is possible. Lang's[2] idea of the chancre is sharply stated, and conveys in a few words the prevailing sentiment of the past twenty years at least. He says that a morbid focus is developed, and

[1] "Excision der Ulcus Induratum," *Berl. klin. Wochenschrift*, No. 27, 1867; and "Zur Geschichte der Excision der Ulcus Induratum," *Centralblatt für Chirurgie*, Nos. 23 and 24, 1879.

[2] "Wege und Wundlungen des Syphiliscontagiums, et cet.," *Mittheilungen der Wien. med. Doctoren Collegiums*, xiv. and xv. Band, 1888–89.

at its periphery a cell-wall is formed which acts as a temporary barrier or blockade. In due time (during which the syphilitic virus is germinating and maturing) this melts away or disappears, and then the virus is carried into the surrounding parts by the lymphatics and the blood-vessels, and by slow contiguous tissue-infection. In this connection it must be mentioned that the experiment of Cohnheim had much to do with fortifying the view of the local nature of the young chancre. This observer threw into the anterior chamber of the eye of a rabbit, by means of a hypodermic syringe, a small quantity of tuberculous matter. For eight days no change whatever was observed, but after that date liquefaction and absorption took place, and in due time the infection of the whole organism followed. Under these conditions it is not strange that the belief in the prophylactic benefit of excision of chancre is extensively held, though it must be confessed that there are not a few who scouted the idea and claimed syphilis as a constitutional disease from the first.

Hüter's paper, already mentioned, while it marks an era, was not productive of great results in the utilization of this method, and it was not until the appearance of two essays by Auspitz[1] and Unna in 1877 that excision of chancre was extensively tried. These observers reported 33 cases in which chancres were excised, of which in 14 success was claimed, in 10 failure was conceded, and in the balance the records of essential facts were so incomplete that they were thrown out. The results here obtained, fortified by the high reputation of Auspitz, made a decided impression upon the medical world, and from this date excision of chancre was largely practised in Germany, and to a less degree in Italy and France. In America and England syphilographers looked coldly upon the procedure, which, it may appear strange to say, in their hands gave uniformly barren results. Auspitz and Unna's paper was followed by a second one by Auspitz[2] alone, in which he took the ground in an unqualified manner that the initial sclerosis should be looked upon as a symptom local in character. This assertion had certainly the greatest weight in causing the quite general adoption of excision of chancre as a prophylactic for syphilis. It had much to do with clinching in the minds of physicians the impression that at first the syphilitic process is a strictly localized one. The chancre came to be regarded as the concentrated effect of the virus, and that for contamination of the system to occur the changes inherent in it must go on to maturity before its poisonous elements could be scattered

[1] "Ueber die Excision der Syphilitischen Initial Sclerose," und "Die Anatomie der Syphilitischen Initial Sclerose," *Vierteljahresschrift für Dermat. und Syphilis*, 1877, pp. 107 and 200.

[2] "Ueber die Excision der Hunter'schen Induration," *Wiener med. Presse*, Nos. 50 and 51, 1878.

generally throughout the system. Auspitz and Unna were the first to bring out clearly the invasion of the vessels in the early stages of syphilitic infection. They, however, evidently reached the conclusion that the vessel-changes were limited to the area of the chancre, and that they only extended slowly beyond that circumscribed region during the latter part of the secondary period of incubation. Cornil's[1] views are also interesting. He says: "We cannot state it in an absolute manner, but we may venture the hypothesis that the syphilitic virus when deposited in the skin remains at first only locally active, but that it gradually affects cells in close contiguity, and prepares them for the hyperplasia which soon forms the chancre." It will therefore be seen that the prevailing ideas of the mode of syphilitic infection favored the view that the disease might be aborted. In the light of facts to be presented later on it would be a waste of time and space to give a general survey of the literature of excision of chancre. Any person desiring further information on this subject may consult the papers mentioned in the foot-note,[2] as well as those already referred to. The facts are briefly these: There have been reported about 460 cases in which excision has been performed, and in about 110 success has been claimed. I have not the slightest hesitation in saying that I do not believe that a single case of syphilis was ever aborted or annihilated by early radical procedures of any kind. Many of the cases reported as cured have undoubtedly been those of soft chancre, which for some reason had become the seat of œdematous hyperplasia; and others were undoubtedly cases of relapsing chancres *in sitû* (the pseudo-chancre, *induré* of Fournier), which are often seen late in syphilis, and commonly are not followed by any other lesions; while still others were in all probability instances of irritated herpes, which so often puzzle even the elect. I have several times seen acarian nodules upon the penis, and also on the outer female genitals, which had been pronounced even by intelligent physicians to be syphilitic neoplasms.

Then, again, besides the probable manifold errors in diagnosis of the excised lesions, in very many instances, the cases were examined too cursorily and for too short a period, or at too long or too frequent intervals. Auspitz himself stated that four months' observation was sufficient. It may be that some of my readers, even in spite of what is said in this essay, may think fit to try excision of chancre as a prophylactic in syphilis. If so, it is well for them to follow the requirements laid down by Fournier[3] in the study of this subject, which are as follows: "1. The man whose chancre is to be removed (and it must always

[1] *Leçons sur la Syphilis*, Paris, 1879, p. 15.

[2] The reader is referred to an article by Leloir, *Annales de Derm. et de Syphiliographie*, vol. ii., 1881, p. 69, and to Kaposi's *Path. und Therap. der Syphilis*, p. 419, for a full bibliography.

[3] "Traitement abortif de la Syphilis," *Gazette des Hôpitaux*, No. 116, p. 1071, 1888.

be remembered that in these very early lesions the appearances are not sharply cast and a diagnosis is often difficult even for the expert) must be confronted with the woman from whom he derived his lesion, and she must be proven to be syphilitic. 2. A precise and clear period of incubation of from two to four weeks must be made out. 3. The observation of the case must be complete and well analyzed, and it must be proved [by microscopical examination—R. W. T.] that the excised lesion is a syphilitic chancre, and that the patient had not previously been syphilitic. 4. The patient must be carefully and at short intervals examined for a period of at least six months." Further than this, I may add that it must be proved conclusively that the patient has not taken mercury surreptitiously, for I can well understand that a man might seemingly consent to excision as a possible cure, and yet not care to take its chances, and for that reason take mercury on the sly.

The study of the question of the abortive treatment of syphilis will not be complete without the consideration of the bearing upon it of a number of cases recently reported showing an unusual mode of evolution of the disease. The following case, reported by Dubois Havenith,[1] will serve as a good specimen: A man sixty years old had coitus in the first days of July. Toward August 1st an erosion appeared on the prepuce which soon became indurated and caused phimosis. The diagnosis of infecting chancre of the prepuce was made. As the ganglia were not perceptibly affected, Havenith entertained the idea of circumcision as a means of aborting the syphilis. He sent the patient to Leloir, who confirmed the diagnosis and advised waiting until secondary manifestations appeared. Havenith has examined the man for a year every five days, and has seen no syphilitic manifestations. In the discussion of this case both Barthélemy[2] and Aubert stated that they had seen seemingly typical indurated chancres which were not followed by syphilis. In like manner, Burnett[3] reports a very striking case of a seemingly typical indurated chancre with inguinal adenopathy, both of which gradually disappeared without any treatment. Though carefully looked for at short intervals during a period of sixteen months, no evidences of syphilis were observed. Burnett quotes a similar case reported to him by Professor J. P. Bryson, and also a case of similar import reported by Kaposi.[4] A further case, reported by

[1] *Comptes Rendus du Congrès international de Dermat. et de Syphilographie*, tenu à Paris en 1889, Paris, 1890, pp. 474, 475.

[2] "Sur les Auto-inoculations du Chancre syphilitique," *Annales de Derm. et de Syphilographie*, 1885, p. 200, *et seq.*

[3] "Induration of Venereal Sores not always an Indication that Constitutional Syphilis will Follow," *Journal of Cutaneous and Genito-Urinary Diseases*, 1889, p. 325, *et seq.*

[4] *Syphilis der Haut und der Angrenzenden Schleimhaute*, Vienna, 1873, Lieferung 1, p. 22

Ehlers[1] of Copenhagen, occurring in the practice of Professor Haslund, is also reported, in which examination for one year failed to reveal secondary manifestations. These facts are certainly very striking, and open up a subject as yet very obscure to us. I have seen several cases similar to those just reported, and although the objective features of syphilitic infection were complete, I have been disposed to look upon them as anomalous instances of simple localized hyperplasia. Perhaps, however, I am wrong. Burnett thinks these cases are instances in which syphilis became inert—as Barthélemy says, aborted—in the primary stage through influences which we do not understand, due to conditions of the organism or to a modification of the virus itself. Besnier,[2] however, is confident that some individuals, though inoculated with syphilis, do not become syphilitic, and he offers the following hypothesis: "When we consider the extraordinary immunity to syphilis presented by the entire animal kingdom, it occurs to us that some individuals, like animals, have in their physical condition, in an elementary condition of their solids and their fluids, something which is antagonistic to the germination of the syphilitic virus. The occurrence of such cases as these suggests the possibility that some of the reported successful cases of chancre excision were really instances in which syphilis aborted in its first stage. Then, again, the thought is suggested to the mind that if syphilis may really abort in its primary stage—in other words, if the patient's tissues are immune to its influence—have we not here another reason why it is well to withhold mercurial treatment until the general manifestations teach us that we have a case of syphilis on our hands?" This point will come up again later on.

In a report to the French[3] Academy of Medicine, Cornil, having gone carefully over the literature of the subject, pronounces excision of chancre futile, and he calls attention to the fact that its use may be dangerous, for the reason that a mercurial treatment may not be instituted and the disease will then run on unchecked.

The negative evidence as to the value of excision of chancre is very strong, and is offered by a number of observers. The classical case of Berkely Hill, in which he unsuccessfully cauterized a tear upon the penis within twelve hours after infection, is well known. Further than this, cases are reported by Razori, Coulson, Gibier, Mauriac, Thiry, Meyer, Zeissl, Zarewicz, Krowcynski, Bumstead and Taylor, and others in which excision was practised at periods of twelve to thirty-

[1] "Cas de Chancre induré non suivi d'Accidents secondaires," *Bulletin de la Société Française de Dermat. et de Syphilographie*, 1890, p. 365, *et seq.*

[2] *Ibid.*, p. 367.

[3] "Rapport sur la Memoire addressé en response à la question suivantes: Precises sur une série d'observations s'il existe un traitement abortif de la Syphilis confirmée." *Annales de Dermat. et de Syphilographie*, 1887, p. 60.

six and forty-eight hours after the appearance of the chancre, in which syphilis developed in its usual way. I have several times removed hard chancres within the first day of appearance, and in each instance failed to abort syphilis. The following personal case well illustrates the average of cases of chancre-excision and its results: A gentleman, aged thirty, came to me early in 1889 in great distress of mind concerning a lesion on his penis which he had noticed for the first time the night before while taking a hot bath. The reason of his fear and worry was that a friend had a few days before informed him that he had contracted a hard chancre from a woman with whom he had learned that he (my patient) had had intercourse. Upon examination I found on the dorsum of the penis a very minute ($\frac{1}{10}$ inch long) fissure of a dull violaceous color. I could discover no change in the inguinal ganglia. At his urgent request I examined the woman and found just within the vagina, in the sulcus on the right of the urethra, a red and inflamed patch, the seat of considerable thickening. In the light of what I found besides I diagnosticated it as a declining hard chancre, of which I had seen many similar before. There was marked inguinal adenitis and a very faint disappearing roseola, a mucous patch on the right pillar of the fauces, and slight fall of hair. The certainty of the syphilitic nature of the sore on the patient's penis, which appeared seventeen days after coitus, being so convincing, its probable character was announced to him. The condition of the skin of the penis was such that the little fissure could be cut away by means of a very liberal elliptical incision, and no harm would be done to the integrity of the organ. Under the most careful technique, with thorough antisepsis, I excised a piece of skin half an inch wide and three-quarters of an inch long on the evening of the day on which the fissure was first noticed and seventeen days after the infecting coitus. Examination of the patient was made almost daily. The wound healed kindly under iodoform gauze, and was not followed by any induration in the minute scar which was formed. It was fully twenty days after the operation that well-marked inguinal adenopathy could be made out. In fifty-two days after the first appearance of the chancre well-marked secondary manifestations were observed.

A very similar case has already been reported by me. Prior to June, 1891, therefore, while the majority of syphilographers believed in the absolute futility of chancre-excision as a means of aborting syphilis, a few still believed in its efficacy in some rather exceptional cases. In May of the same year I read a paper[1] before the Academy of Medicine of New York, in which I think I clearly showed why syphilis is not aborted by chancre-excision. The gist of this paper is as follows:

[1] "Why Syphilis is not Aborted by the Early Destruction or Excision of its Initial Lesion," *Medical Record*, July 4, 1891.

I had had the good luck to be able to remove a hard chancre on the extreme edge of the prepuce, together with the two layers of the prepuce. Thus I had a lesion, and besides it the skin for a distance of more than an inch from the site upon which it was placed. The history of the infection was clear and striking, and proved that the ulcer had appeared fourteen days after coitus. It was seen by me within a few hours of its first appearance. Four days after that the prepuce was ablated, which was exactly eighteen days after the infecting coitus. Seventeen days after the appearance of the chancre inguinal adenopathy was discovered, and in thirty-two days after that manifestation generalized syphilitic symptoms showed themselves. Thus it will be seen that the ablated prepuce was particularly precious, for it contained an initial lesion of syphilis only eighteen days old, and beyond it and proximal to the body an inch and a half of tissue which looked perfectly healthy, and in the light of our knowledge of syphilitic infection would have been considered to be free from the disease. This specimen I placed in the hands of Dr. Van Gieson, with the view of ascertaining the appearances of the initial lesion at its very earliest period of development, and also of finding out, if possible, why under such favorable circumstances its excision had failed to abort syphilis. In order to make the study more complete and perfect, I also gave Dr. Van Gieson a prepuce upon which was seated a chancre ten days' old, which appeared sixteen days after the infecting coitus. This lesion was therefore the evidence of an infection which took place twenty-six days before. The examination of the eighteen-day-old specimen showed that the chancre consisted of a little mass, quite well circumscribed, of small round cells, and was in every way typical of the appearances of an initial syphilitic lesion. But, besides this, it was found that well down under the chancre the small veins were surrounded by this same round-cell infiltration. Then, beyond the margin of the chancre, in skin which to the eye seemed normal, this same infiltrating and infecting process was very clearly observable. This same state of affairs existed in the whole prepuce, and how much farther on the penis it is impossible to tell. The appearances presented by the second twenty-six-days-old specimen were confirmatory of those of the first, showing this vessel-implication far beyond the outer margin of the chancre. These studies therefore go to show that in the very first days of syphilitic infection the poison is deeply rooted beneath the initial lesion, and that it extends far beyond its margin—that it is in a most active state, and, running along the course of the vessels, it soon infects the parts beyond, even to the root of the penis. To my mind, therefore, the facts adduced show very plainly that the infection-process in syphilis is from the very beginning one of constant growth and diffusion. The observations presented in my essay therefore showed that the syphilitic

poison was copiously and extensively diffused through the tissues of the penis by means chiefly of the small veins, arteries, and lymphatics. In confirmation of these observations the results of the studies of the so-called lymphatic cord of syphilis by Dr. Külneff[1] of St. Petersburg are very important, since they show the more advanced stages of this peculiar vessel-change, and of the further progress of syphilitic infection. Külneff excised portions of five of these cords taken from patients having true hard chancres about the prepuce and glans. The cords varied in size from a knitting-needle to a lead pencil, and were from a fortnight to ten weeks old. Külneff concludes that the cord occurring in cases of primary syphilitic sclerosis results from inflammation of the subcutaneous veins of the penis. In other words, it is a manifestation of syphilitic endo- and peri-phlebitis. The morbid process commences primarily in the vein, probably in its interior, and from it infiltration of granulation-cells occurs. In short, the results of the examination of my cases dovetail completely and conclusively with those of Külneff, who studied the syphilitic process farther up the penis in the larger vessels, which were the seat of a more advanced infection. The conclusion is warranted, I think, that the changes which take place in the chancre and small radical vessels run up quite promptly to the larger efferent vessels, and that largely through them is the poison diffused into the system.

These clinical and pathological observations therefore show why syphilis is not aborted by early excision or destruction of its initial lesion, even including a liberal slice of the surrounding parts. The reason, succinctly stated, is, that (contrary to the prevailing views) the syphilitic infective process is from the very start a quite rapid one. The poison strikes directly for the blood-vessels, and, causing there its peculiar changes, runs along them with astonishing rapidity. Thus it gains a foothold in parts beyond the reach of the knife, caustics, or electrolysis. In fact, the tissues of the whole penis in very early syphilis are, we may say, honeycombed by these infected vessels. These observations, supported by the evidence of the failure in chancre-excision, go to show that beyond the chancre there is sufficient syphilitic poison to infect the whole system, and that the initial lesion, through the visible and exuberant evidence of syphilitic infection, may be removed without in any way altering or modifying the course of the disease.

In my judgment, therefore, irrefragible proof has been offered which clearly shows the absolute futility of excision of chancre as a prophylactic of syphilis. It is necessary, however, as a matter of

[1] "On the Question of the So-called Lymphangitis in the Early Stage of the Primary Syphilitic Sclerosis." *Inaugural Dissertation.* (Under the auspices of Professor Tarnowsky.) St. Petersburg, 1889.

history, to record here in a brief manner the further and more radical operations which have been proposed for the extinction of syphilis. The recital will certainly act as a warning to future experimenters and theorizers, particularly if they will read what has just been said of the early stage of syphilitic infection. In 1871, Vogt[1] proposed that in addition to the extirpation of the chancre, a like operation should be performed upon the inguinal ganglia. In the year 1872, Hardaway[2] in an elaborate paper showed that, according to existing views, syphilitic infection took place through the lymphatics, and arrived at the logical conclusion that extirpation of the ganglia, in connection with the chancre, offered a reasonable chance of aborting the disease. He simply made the suggestion, unsupported by clinical evidence. Bumm,[3] however, in an article advocating chancre-excision, detailed seven cases in which the ganglia were extirpated, and in two of which he claimed that he had aborted syphilis. The next noticeable article on this subject was by Leuf,[4] who in an essay based on theoretical grounds regarded excision of chancre as only a halfway measure, and advocated the extirpation of the lymphatics of the penis and also of the lymphatic ganglia. Seeing that no harm has been done, both Hardaway and Leuf may be pardoned for their chimerical proposals.

In this connection it may be interesting to remember that Neumann[5] recently showed a case of a man in whom he removed the chancre and the inguinal ganglia on the thirty-first day after the infection. Secondary lesions promptly appeared, followed later on by tertiary manifestations, which Neumann exhibited to the Vienna Medical Society.

This operation, if performed, occurs at an epoch in a patient's lifetime in which every effort should be made to place him in a position of superior mental and physical health, and when anything which may act as a shock or drain upon his system must be most sedulously avoided. For these reasons alone it is to be shunned. The operation is based upon false ideas of the pathology of syphilis. In the first place, it assumes that the virus of syphilis is in a fluid form, germinated and developed in the initial lesion; and in the second place, that this fluid virus runs up the lymphatic vessels of the penis without exudation or leaking, as Croton water runs from the reservoir to our houses. Now, the truth

[1] *Berliner klinische Wochenschrift*, 1871, No. 38.

[2] "The Pathology of Early Syphilis," *St. Louis Medical and Surgical Journal*, May, 1872; also, "The Lymphatic Theory of Syphilitic Infection, etc.," *N. Y. Med. Journal*, vol. xxvi., 1877; and "The Radical Treatment of Syphilis," *ibid.*, Sept. 26, 1885.

[3] "Zur frage der Schanker-excision," *Vierteljahr. für Derm. und Syphilis*, 1882, p. 259, *et seq.*

[4] "On the Eradication of Syphilis during the First Stage by Surgical Means," *N. Y. Med. Journal*, July 11, 1885.

[5] "On the Excision of Primary Sores and Enlarged Glands," *British Med. Journal*, May 19, 1890.

is, that the syphilitic virus or poison is an entity, and while it may, and perhaps does, contain a fluid plasma, undoubtedly, as shown by the microscope, it is made up of peculiar infecting cells, and the process of systemic invasion depends upon the peripheral increase of the original infected area. Secondly, this invading poison, whatever it may be, does not infect the system through two or more closed channels or pipes (lymphatics), but like an army with the skirmish-line thrown out, followed by the invading body, is powerful along its whole line of advance. In this way the whole system becomes infected, and the culmination is reached at the period of generalized manifestations.

Extirpation of the ganglia, therefore, is not in any way indicated by the pathology of syphilis, and it may be classed with many other surgical vandalisms which unfortunately to-day are too frequently perpetrated.

It may be stated, however, that in some cases, where the anatomical arrangement of the parts warrants it, excision of chancre may be performed with benefit, thus removing a conglomerate mass of infection and a lesion in many instances slow to disappear.

We come now to the second question: Can we by a general preventive treatment suppress, abort, favorably attenuate, or modify syphilis? Within a few years a method of treatment has been advocated which has for its purpose the eradication of syphilis by the prompt and vigorous use of mercury as early as possible in the primary stage. This treatment is really not new, since it is the same as that advocated by Fournier, Bäumler, Mauriac, and others, who give mercury just as soon as the diagnosis of syphilis is made. If there is any difference between it and other methods, it is that the advocates of a general preventive treatment put a little more energy in their words, if they do not in their mercurial, and support their method by pleasing (to some) sentimental talk. The eminent surgeon, Mr. Jonathan Hutchinson, has within a few years published a very interesting paper on this subject, which does for it all that ingenuity of argument can do. Mr. Hutchinson[1] says that "if a scheme of treatment, begun in the primary stage, is planned to prevent the secondary phenomena, and generally does so, it may, I think, be fairly styled abortive in contradistinction with others which make no pretence to prevent the ordinary evolution of the malady." Certainly, such a treatment might be called abortive if it did prevent secondary manifestations and stamp out the disease, but no one thus far has given us any evidence that such a treatment has produced such a result. Mr. Hutchinson says that we must not strain the word "abortion" to mean utter annihilation, and he concedes that after his early and active medicinal dosage (using

[1] "On the Abortive Treatment of Syphilis," *British Medical Journal*, Feb. 25, 1888; and "The Modern Treatment of Syphilis," *The Practitioner*, June, 1891.

gray powder) he sees, somewhat exceptionally, scaling patches on the palms of the hands, sores in the mouth, and sometimes a general rash; and again, in some cases, tertiary lesions. As a matter of fact, therefore, he has seen the secondary stage delayed and the third stage not prevented. Seeing that such early and late manifestations have really appeared after the trial of a well-ordered and vigorous early preventive mercurial treatment, the thought obtrudes itself upon us that in cases in which such an early treatment has not been followed by general manifestations a simple non-syphilitic sore, in its incipiency, has been diagnosticated as a hard chancre. It is very often impossible for many days to say that a given sore is syphilitic, though it may present a specific appearance. Consequently, the liability to error on the part of those who in the very earliest days of a sore begin mercurial treatment is very frequent and very great. But an attentive reading of Mr. Hutchinson's paper has convinced me that his abortive method is a treatment of sentiment rather than of reality. He tells us that the early free use of mercury causes the indurated nodule to melt away with astonishing rapidity—a fact which can very frequently be verified by any one. But it must be remembered that this induration is not a very early sign or symptom of syphilis, considering the requirements of this early abortive treatment. It may be stated, I think, without fear of contradiction, that when we encounter a well-marked indurated nodule, that lesion is at least two weeks, and more probably three or even four weeks, old. Induration in a few cases occurs quite rapidly, but in most cases, particularly in private practice on careful and cleanly persons, the initial sore is soft, or, rather, not appreciably hard, for one or two weeks and sometimes for a longer period. After that time induration may develop more or less rapidly. Therefore, I am led to think that in many cases Mr. Hutchinson's abortive treatment merely antedated the evolution of the secondary period by a short time. Then, again, Mr. Hutchinson speaks of the early involution of the syphilitic fever under active mercurial treatment as being an evidence of the early abortion of the disease. It is true that mercury will lower the temperature in early syphilis, but it is none the less true that this rise of temperature is generally concomitant with the appearance of general manifestations, though in some cases it may be observed a few days or a week, or at the most ten days, before that critical period. Here, again, we have in Mr. Hutchinson's paper intrinsic evidence that while he entertained the idea that he could abort syphilis in some cases, he only began the treatment at about the same time that others usually begin it. I have taken the pains within a few years to question carefully a number of gentlemen who begin the use of mercury early, or who rely upon its early use, as a means of aborting syphilis, with a view of ascertain-

ing just how soon in the life of the sore or in the evolution of syphilis they begin a mercurial treatment, and I found them divided into two groups: in the first are those who as soon as they see a sore which they regard as suspicious immediately give mercury; and in the second those who are more careful and scientific, and who by their own confessions admit that they allow days and weeks to elapse in many cases pending the verification of the diagnosis of syphilis. So that I am led to think that while many men cajole themselves with the idea that they begin the treatment of syphilis at once, really, for one reason or another (chiefly those of doubt and uncertainty), they usually wait wellnigh up to the date of secondary manifestations, if not, indeed, up to it, before they begin general mercurial treatment. They pass current, however, as advocates of early mercurialization. The truth is this, that in the hands of most men who are careful and conservative the disease is well on to its stage of generalization before treatment is instituted.

A method of general abortive or preventive treatment of syphilis has been worked out by Bronson on a purely theoretical basis. Bronson[2] thinks that we may cause the rapid disappearance of the initial lesion and the probable abortion or prevention of the secondary stage by hypodermic injections around and under the nodule on the penis into the substance of the inguinal lymphatic ganglia, and into the territory of integument "whose lymphatic vessels tend in their course to the ganglia which are the seat of the disease." This theory was perhaps tenable in the days when we thought that the chancre was the circumscribed focus of deposit of the virus, that the lymphatic vessels were its means of transportation, and that the nearest ganglia were the storehouses of the ripening infection. But to-day we know, as shown in the preceding section, that the virus of syphilis is scattered generally on and in the small vessels, and that it rapidly diffuses itself, passing at an early date by the veins into the abdomen. Practically, the injection of mercurial solutions under the chancre and under the skin of the penis will turn out in any one's hands a failure, and a source of discomfort, suffering, complaint, and lamentation on the part of the patient. Though this procedure was advocated by Weisflog, Lipp, and Lewin some years ago, I have no knowledge of its adoption and use by any one. Therefore I think that Dr. Bronson's charmingly written essay, which ends with this passage, "Better it is to act on any chance, however slender, than be bound helplessly to a dogma that is open to question, and that would leave the victim of an insidious infection without succor and without hope during what may be the most momentous period of his disease,"

[1] "On Preventive Treatment of Primary Syphilis," *New York Medical Journal*, March 24, 1888.

will go to posterity as a sample of good English composition and of humane inspiration, rather than as a watchword against a supposed lethargy in the therapeutics of syphilis. In my judgment, the early preventive treatment is barren of beneficial results, and leads to all sorts of errors regarding all kinds of sores found on the human genitals. I have never seen, nor have I heard of, a well-detailed authentic case of syphilis thus cured, and I doubt whether I ever shall. Consequently, I am not a believer in the practical application of Fournier's dictum, that it is easier to prevent than to cure. I agree with Kaposi regarding the early preventive treatment of syphilis, that it is rational and humane, but not practical.

In support of what I have said I think it well to present the views of a number of eminent authorities. Thus, Kaposi[1] declares that early treatment does not prevent the appearance of the general symptoms, but only delays them, that the symptoms appear irregularly, and that mild eruptions do not occur exclusively, but that there may be very early severe symptoms. Not alone is the development of severe symptoms, especially those of the central nervous system, accelerated, but in rare cases, in which severe early symptoms remain absent, injury results to the patient in that the syphilis runs a much slower course than when no early treatment has been adopted. Doutrelepont[2] very correctly states the case when he says: "Sometimes very disagreeable gummous forms appeared, although the milder secondary symptoms had remained absent." Neumann[3] also states the facts very clearly when he says that while cutaneous eruptions and enlargement of the ganglia predominate when there has been no early preventive treatment, after the latter we find that the mucous membrane of the mouth and pharynx, especially the lips and tongue, are particularly apt to present patches (and ulcers) in spite of the most careful local treatment. He found that the rash is delayed about sixty-two days, and I have seen it appear as early as that, and as late as ninety and one hundred and twenty days. He rightly concludes that the success of the early preventive treatment is ephemeral, and that notwithstanding its adoption syphilis will inevitably run its course. Further than this the words of Kobner[4] are of great significance. This observer up to the sixties of this century followed the routine then in vogue—namely, early preventive treatment—and he declares, with large experience, that he has seen only two cases in which the outbreak of general symptoms was apparently entirely prevented. In all other cases he saw syphilis run its course in spite of a

[1] "Ueber Therapie des Syphilis," Separat abdruck aus der *Verhandlungen der Congresses für Innere Medizin*, Wiesbaden, 1886.

[2] *Ibid.*

[3] *Ibid.*

[4] *Ibid.*, and "Aphorismen zur Behandlung der Syphilis," *Berlin. klin. Wochenschrift*, Dec. 29, 1890.

most active inunction-treatment during the primary period. He further says that, unfortunately, he has frequently observed that those individuals who had received inunctions immediately after the diagnosis of the primary lesion exhibited disproportionately early severe and fatal symptoms on the part of the central nervous system. Equally as significant are the words of Bärensprung,[1] who says: "I have seen the most severe and rapid destruction almost always in those cases in which inunctions were used against the primary or first secondary lesions;" by which latter he means the inguinal adenopathy. Diday also is opposed to an early preventive treatment, and Leloir concludes that it is productive of no good. Finally, I may quote the recent utterances of the younger Zeissl,[2] who voices the opinion of his deceased father as follows: "As a compensation for the few days delay in the outbreak of the general symptoms these run an irregular course, and severe forms occur early. A further disadvantage of mercurial preventive treatment is the fact that the syphilis becomes more obstinate in so far as the symptoms of the condylomatous period yield much more slowly than if mercury has not been used until the appearance of this stage. We have therefore achieved nothing by preventive treatment, except to weaken our chief weapon against syphilis." Further evidence certainly is not necessary. I can confirm from prolonged observation and experience all that these authorities have said and claimed as to the inutility, general unadvisableness, and even danger of an early preventive treatment.

Systemic Treatment.

The Time to Begin Treatment.—The next question for consideration is the following: Shall we begin general systemic treatment as soon as a positive diagnosis is made, or shall we wait until the evolution of the secondary period proves to us that the climax has at last been reached, and that the whole organism has been involved? We have already seen that no clear evidence has been adduced proving that an early mercurial course can abort or favorably modify the syphilitic infection; and it has been shown that, in spite of such treatment, early and late lesions have appeared. This fact has been observed by many physicians. As I have already said, it is very probable that few authorities follow the letter of the law which they lay down—namely, to begin treatment at once as soon as they are reasonably certain that they have syphilis to treat. Though the advocates of this method of procedure are quite numerous, those who counsel delay until all possible doubt of diagnosis is removed are even more

[1] *Die Hereditäre Syphilis*, Berlin, 1864, p. 17.

[2] "Der Gegenwärtige Stand der Syphilis-therapie," *Klinische Zeit und Streitfragen*, Vienna, 1887, p. 173.

numerous. These advocates of early treatment base their view largely on sentimental grounds, and do not present strong, telling facts in their support. They picture a patient in the meshes of a severe chronic infectious disease, and claim that the dictates of humanity call for its early eradication. On the other hand, those who advocate a policy of delay are equally as much impressed with the gravity of the patient's position, and are equally ready and zealous to help him; and they think that they can do so with more certainty by waiting until they have a distinct morbid entity to treat than they can if they begin the use of mercury when the disease is yet in an unsettled and mythical condition. At best, early treatment only delays the appearance of secondary manifestations for a longer or shorter time, and as a rule does not lessen the severity or extent of their distribution, and in many cases seems to render them more severe. And when we have said this we have said about all that we can in favor of the treatment of syphilis, early or late, in its primary stage. On the other hand, it is the consensus of opinion of very many eminent men, as we have already seen, that this early treatment is really productive of harm, in the fact that it induces a disorderly course of the disease.

Moreover, early treatment takes from the physician at the outset —which is the most important period in the life of the syphilitic —those criteria which are to guide him in the management of the patient, and very often leaves him in a very uncertain and uncomfortable state or condition of uncertainty and doubt as to whether his patient is really syphilitic. Then, again, when a patient has been pronounced to be syphilitic he himself generally wants to see some undoubted signs and symptoms of the disease. I have many times seen patients who had received early mercurial treatment, and had witnessed no other evidence of syphilis than a chancre, cease treatment or refuse treatment after the lapse of a month or two of early mercurialization, and later on develop severe, and even deadly, lesions. Many patients, seeing nothing on their bodies in the early months of the infection (as a result of early treatment), convince themselves that they never had syphilis, and others remain in doubt, and in very many cases they will not follow subsequent treatment in the persistent and methodical way which is so essential for the cure of the disease. These cases have a surfeit of treatment very early in the disease, and an absence of it later, so that while they are not the gainers by the early medication they are often, to their sorrow, the losers by the absence of treatment at subsequent periods. Further, we must, as Von Düring[1] remarks, consider fully the mental injury inflicted upon a patient by a premature, and perhaps unfounded, diagnosis of syphilis, which causes him during his whole

[1] "Frühbehandlung der Syphilis oder Nicht," *Monatshefte für Prak. Dermat.*, vol. ix., 1889, p. 490.

life to be in constant dread of relapses, and, I may add, to be in a state of mind which attributes to his early (perhaps putative) syphilis every lesion or affection, however simple, which may thereafter befall him. To my mind, it is most salutary for the syphilitic to be convinced beyond any doubt that he is syphilitic, for in most cases the revelation brings him to a realization of his true condition, and impresses upon him the necessity of care and watchfulness as to his mode of life and docility to his physician, in order that in due time he may be cured.

Let us now turn to the pathological condition which syphilis presents. It is chronic and infectious in character, and manifests itself by the development of a low grade of connective tissue, which tends to indefinite reproduction in greater or less degree through periods of activity and remission in any and all of the tissues and organs of the body. In all probability the malign influence of syphilis upon the human organism is directly due to the infiltration of this tissue, to the irritative and inflammatory conditions incident to the hyperæmia which accompanies this proliferation, and last, but far from least, to the secondary destructive and atrophic changes which take place in the tissues in the various metamorphoses of these specific new growths. Clinical and pathological observations have shown that mercury possesses a specific power over this low grade of infectious tissue, and it is very probable that it causes its necrobiosis or its burning up, or that it produces its removal by the induction in it of fatty degeneration, which renders it ready for absorption. In my judgment, syphilis is not mature until the date of secondary manifestation, when the newly-formed young round cells are proliferated in vast quantities, and are thrown into the general circulation, and by it carried throughout the body. In the same way in the acute infectious diseases smallpox is not ripe until the evolution of the pustular rash, nor scarlatina until the appearance of its intense generalized erythema. When, therefore, the morbid processes have so far advanced that a generalization of their products has occurred, syphilis may be said to be ripe, and then, and not till then, have we anything really tangible to treat. Mercury given before this critical cell-explosion has very little to work upon, and therefore is productive of a limited amount of good. Indeed, to my mind, when given thus early, while it may have some influence upon local processes (namely, on parts the seat of the chancre and the adjoining territory), it is productive of harm by influencing the tissues too early, which influence does not give them an immunity to the subsequent syphilitic process of invasion. In other words, mercury given before the generalization of syphilitic products does not favorably influence the resistance of the tissues to the impending invasion, and certainly does not render them immune to it. On the contrary, the early exhibition of mercury induces a condition of tolerance in the

tissues which renders its action less powerful and certain at a later date when they are infiltrated with syphilitic products. In short, we take the cutting edge off of our most potent remedy by administering it to a system as yet not charged with the virus which it is our hope to destroy. We are really treating before we have got anything to treat.

We very frequently see a parallel condition later on in syphilis in patients who have for long periods taken small and continuous doses of mercury, and in whom (as so often occurs) syphilitic new-growths appear in the skin and elsewhere. In these cases a low grade of mercurialization is induced which has no power at all over syphilis, since its lesions appear notwithstanding the fact that the patient is taking mercury regularly. Now, this mercurialization tends to lower vitality and impair nutrition, and the general condition which it induces ties our hands, so that we can do very little good with mercury until the system has been renovated; then by the use of proper doses of the drug the syphilitic lesions may be made to yield.

There is another important consideration. In the primary period of syphilis it is well to prepare for the secondary stage by fortifying the patient's system, by putting him in a good physical condition, and in preparing the stomach, if necessary, for the ordeal which it will have to pass through. In this primary period in very many cases tonics and remedies designed to improve digestion should be given. Then in due time mercury will be well borne, and it will promptly act upon the syphilitic virus and its effects.

I have carefully studied this question for more than twenty years, and I am now more than ever convinced that it is by far the best plan in most cases to wait until the onset of the secondary stage before we begin a mercurial course. In thus waiting it must be remembered that we are not to fold our arms and do nothing; we must regularly examine our patient; we must look after his general well-being, mental and physical, encourage him with hopeful prospects, and prepare him for his coming ordeal, the crucial one perhaps of his life. Then, just as soon as general symptoms and manifestations begin to appear, and we know that we are right and appreciate fully what we have got to treat,—then we must begin our mercurial treatment with vigor tempered by watchful care of our patient and an enlightened and conservative knowledge of therapeutics.

While, therefore, it is best to begin the treatment of syphilis at the very earliest moment of the secondary period, there are conditions or exigencies which arise in the primary period which call for, and sometimes demand, the very early administration of mercury. These may be summed up as follows:

1. When the initial lesion from its site, size, depth, or extent causes

much pain and discomfort or interferes with the function of parts, or from activity of ulceration threatens to destroy them—prepuce, penis, urethra (chiefly in cases of phimosis and paraphimosis), clitoris, fingers, eyes, nose, lips, tongue, tonsils, breast, and anus. Also in cases in which dense induration around the urethral orifice or in the urethral canal produces a stenosis of that canal, and again in cases of very large (elephantine) extra-genital chancres upon the legs, arms, buttocks, and cheeks or face.

2. In some cases in which there is a tendency to the development of exuberant indurating œdema around the chancre, which may seriously discomfort or cripple the patient or impair the functions of the part, as we sometimes see in chancres of the lips, near the frænum, and upon the external female genitalia, and complicating chancres of the anus, and also in cases of chancres just within the vaginal introitus.

3. In certain of those cases in which, from its situation, the chancre may lead to infection of others, such as the fingers of surgeons, obstetricians, dressers, orderlies, and midwives, the nipples of wet-nurses and others who suckle children other than their own, in cases of chancre of the lips and tongues of infants, and in cases in which the lesion occurs on the lips or elsewhere of young, careless, and thoughtless persons who are liable to spread the infection.

4. When the enlargement of the lymphatic ganglia or the lymphatic cords (particularly of the penis) is excessive and causes inconvenience, impairment of function or locomotion or movement of the arms, or produces much discomfort and disfigurement in the neck and submaxillary region, at the elbow, in the axillæ, and groins.

5. In some cases in which chancres are complicated with a pyogenic infection attended with pain, fever, and perhaps typhoidal symptoms, chiefly on the fingers, but also, though rarely, on the nipple and mammæ, and sometimes on the penis and vulva (in careless, uncleanly subjects). Also in some cases in which gangrene and phagedena are complications.

6. In cases in which conjugal or sexual relations render the disappearance of the chancre necessary or imperative.

7. When the extreme anxiety and fear and the unreasonable impatience of the bearer render it imperatively necessary.

8. In those somewhat exceptional cases in which severe cephalalgia, neuralgia, pleuritic and interthoracic discomfort and pain, pains in the bones, joints, and fasciæ, are precocious.

9. In cases of women infected in the early months of pregnancy, in order, if possible, to prevent subsequent abortion; and in cases of chancre of the vulva and introitus vaginæ in order to remove a possible obstacle to childbirth, and, if very late in gestation, to prevent the infection of the child *in transitu*.

Kaposi[1] says that whenever he has been led astray by logic or external conditions to adopt a general treatment by mercury before the onset of the second stage, he has been sorry for it afterward; and my experience in the main accords with his. In these early medicated cases there are always, of necessity, data and criteria lacking, and as a result the physician does not feel as certain of his ground as he does when he and his patient have seen the earliest general manifestations of syphilis, and when he has by their observation and study gained a pretty clear general idea of what course the syphilitic infection is going to take.

To sum up, then, we may state that in most cases no advantage or possible benefit to the patient is lost by withholding mercury until the onset of the second stage, nor is the patient thereby put in any jeopardy, present or future, nor are his chances for ultimate permanent cure in any way impaired, modified, or crippled. On the other hand, his syphilis will be more orderly, and conspicuously more amenable to treatment, his physician will not grope in the dark, and will, if he promptly attacks the disease in the conservative but vigorous manner soon to be detailed, be spared the hesitancy, doubt, and uncertainty of mind which are the inevitable lot of those who attack the disease prematurely.

The date, therefore (as a general rule), at which the treatment of syphilis should begin is that at which the disease culminates in the general infection of the economy—namely, just as soon as the general rash appears, together with the other manifold symptoms of the secondary period.

Mercury.—The experience of more than three hundred years has shown, in no uncertain manner, that mercury has the most marked and salutary effect in the treatment and cure of syphilis, and that if properly handled it may almost be termed an antidote or specific for that dread and protean disease. Though sarsaparilla, guaiac, saponaria, stillingia, smilax, chinæ, sassafras, dock-root, cascara amarga, berberis aquifolium, tayuya, and other vegetable agents, as well as preparations of gold, silver chromate, etc., have from time to time been put forward and vaunted as the true specifics, they have none of them attained a firm standing in the therapeutics of syphilis, and have each been abandoned as powerless and worthless. To-day there are few authorities who decry or inveigh against mercury, whereas fifteen or twenty years ago the doughty, noisy, illogical, and bigoted disciples of old Ulrich von Hütten were ever ready with their imprecations against the drug, and with their false assertions as to its dangerous and even lethal character.

Mr. Hutchinson,[2] referring to British medicine, says: "Excepting in Edinburgh, I believe that there are at present in the profession

[1] *Loc. cit.*

[2] "The Modern Treatment of Syphilis," *The Practitioner* June, 1891, p. 463.

scarcely any anti-mercurialists left, and I may remark, in passing, that during the last few years some of the most severe cases of syphilis which I have seen have come from Edinburgh, and had been treated in the early stages by systematic abstinence from mercury." I know of no anti-mercurialists in America.

Used carelessly and in the unstinted manner of old times, mercury certainly may be productive of harm; but in no department of medicine have more advances been made and more enlightened conservatism been engrafted than in the treatment of syphilis by mercury. In place of the powerful doses and inevitable salivation and other bad results arising from the use of mercury as given years ago, we to-day use milder doses, which produce amelioration and cure of the disease without, as a rule, untoward complications. While it may be said that the modern attenuation of the dosage of mercury has been an incalculable advance in syphilis therapy, it must also be confessed that in the hands of some physicians this attenuation has gone on almost to the point of emasculation. In other words, in the reaction from the rash and vigorous mercurial dosings of other days some observers have jumped too far, and to-day give mercury with so sparing a hand, and with so much mystifying arithmetical calculation, founded on theory rather than on prolonged observation of the disease and its treatment, that they produce a treatment which is really a perversion of one of the greatest therapeutic blessings which we possess. While, therefore, mercury is by all odds the great and reliable remedy against syphilis, its dose must not be too much attenuated. On the other hand, it must not be administered with too lavish a hand, but carefully, guardedly, with full and repeated observation of the patient's general condition, and with a watchful care as to how the lesions are affected by its use. In short, the treatment of syphilis means on the part of the physician a full knowledge of the disease, a consideration of the patient's strength or weakness, a close familiarity with his lesions and with the workings of the syphilitic virus in his system, and an accurate knowledge, based upon frequent observation and interrogation, of the manner in which the remedial agent affects his system and the general morbid condition. In other words, the physician has not the abstract problem—syphilis—to treat, but he has a human being infected with a chronic multiform disease as the subject of his study, and for whose relief and cure he must familiarize himself with his constitution and watch and guide the effect of his therapeutic agents.

As an adjuvant to mercury in the main, and rather exceptionally as the mainstay of syphilitic medication, we also have iodide of potassium and also of sodium. These agents play a very important part in syphilitic therapeutics, and fully claim second place to mercury.

Then, also, we have as adjuvants all kinds and modes of hygienic

and careful regimen; and we invoke to our aid all the most efficient tonics and hæmatics. Let us now consider some of the principal methods of treating syphilis in vogue at the present day.

Expectant Treatment.—The expectant treatment is the outcome of the theoretical cogitations of Diday, and is advocated mainly by himself and the younger Zeissl, who inherited this therapeutic heirloom from his father, who was also given to Diday's way of thinking. It is an easy-going, happy-go-lucky system of therapeutics, which is fraught with uncertainty, danger, and disaster to the unhappy person who is subjected to it. As a piece of sophistry these therapeutic lucubrations of Diday charm us by their bright diction and their brilliant but untenable assumptions. The only points worthy of mention in this treatment are—first, that it carries with it injunctions to begin treatment, as a rule, at the commencement of the secondary period; and, second, that all cases have their own peculiar form of this disease, and that they must be watched as to the character, extent, and portentousness of their manifestations from early until late. The latter injunction is to my mind the only part of Diday's writing upon this subject worthy of remembrance. Diday claims, for the reason that a small percentage of cases seem to end in the secondary stage, that syphilis is a self-limited disease, with a constant tendency to expend itself, or, as we may say, run itself out. He divides syphilis mainly into two varieties—the mild and the severe—for each of which he gives mercury only temporarily according to various figurative data. He calls his system also the opportunistic treatment, and bases it upon the assumption that Nature makes an effort to rid itself of syphilis. He very rightly emphasizes the importance of careful hygiene and regimen during the course of syphilis. He denies *in toto* any preventive action of mercury, particularly in the secondary period, and claims that in many mild cases tonics and hygiene will cure the disease. He singularly fails to emphasize the fact we so often notice, that a very mild early syphilis very often leads to disaster and death. Succinctly stated, Diday's opportunistic treatment consists in giving mercury or iodide of potassium when syphilitic symptoms show themselves, and when these have disappeared to wait again for another outburst. He is emphatic in his disbelief that mercury has any preventive or curative action in the intervals of repose or latency. Though I think that Diday's doctrine of therapeutics is false, sophistical, and dangerous, it is none the less a part of the history of syphilis; therefore I give it here for what it is worth, as it may appeal favorably to some minds. Not only do his therapeutic assertions hinge very often on false clinical foundations, but his deductions are very often based upon pure hypotheses and assumptions. I will quote liberally from his most recent utterances.

Diday[1] accepts the microbian origin of syphilis, chiefly on analogical grounds, for he concedes that the microbe has not at all been clearly demonstrated. A microbe being of vegetable origin, he ingeniously argues that when, as a pathological factor, it is deposited in the human tissues, it runs its course according to the law of vegetable life, in which are observed alternating periods of activity and of repose. He thus continues: "Now, the first attribute common to bodies of this order (for it is the condition of their development) consists in the two phases which alternately succeed each other: the one of repose—*latent life*; the other of activity—*manifest life*. Now, this is the character of syphilis, which from its commencement to its end is marked by a series of sleepings and wakings; that is to say, intermissions, then resumptions of manifest life; and resumptions to which medical language has justly given the name of *manifestations*. These manifestations in every plant mark the period in which it borrows from the surrounding media the elements necessary to its growth. It is therefore during this state, and it is only during this state, that there are established admissible exchanges between the media and the plant. Consequently, the media can act favorably or unfavorably upon the plant. The evolution of syphilis is strikingly intermittent. Does not this character, which is its distinctive sign, indicate a state equally intermittent in the vitality of the vegetable organism presumed to be its cause? This demonstrated, the law applies itself most naturally to our pathogenic microphytes. Our organism is the habitat of these parasites, their feeding-ground, their field of battle and of strife against the defensive forces of our living tissues." He then goes on to say that if these organisms overwhelm us, we must try to exterminate them. "If we wish that our tissues (terrain) shall cause their death, we must prepare them to that end the moment they show signs of life. Since we cannot by means of the soil (living tissues) attack the microbe, we must wait until it begins to increase and multiply. It is a benefit of nature that at the time when the microbe becomes pathogenic it is particularly accessible to our means of attack. The principle of this therapeutic system consists in waiting in the employment of specifics until the evidence of manifestations, and after a study of their clinical physiognomy we can first seize the moment when the pathogenic agent awakes and is at the minimum of its resistance; and second settle in our minds the nature, the doses, and the duration of the medication necessary to oppose it." Lancereaux laconically sums up Diday's system as follows: "When there is a lesion, intervention; in the intervals, expectation."

It may be remarked that it seems almost foolhardy for a man to base a system of therapeutics upon a simple hypothesis, and yet this is

[1] *La Pratique des Maladies vénériennes*, Paris, 1890, p. 380, *et seq.*

what Diday has done, supporting it with far-fetched analogy and a pure and simple assumption of the behavior of the various syphilitic processes. What evidence have we that the cells of syphilis behave in the tissues of man as do the seeds of the vegetables in the fields? The one process is pathological, the other normal, the latter depending very much for its development upon cyclical changes of time and season, the former upon the various unknown conditions of the disease and numerous complex conditions of the human system.

If any one wishes to get a good idea of the expectant or opportunistic system of treating syphilis, let him study the disease in dispensaries, clinics, and hospitals. Patients who are treated in these institutions as a rule do not apply until more or less urgent manifestations and symptoms begin to trouble them. In general, they merely get patched up, for they only remain as long as their immediate trouble is present and urgent. Then off they go, to return later on with new and perhaps worse manifestations, no medicine having been taken in the mean time. Then, again, let any man who sees in his practice many cases of syphilis watch those who follow treatment regularly and carefully, and compare their condition with that of patients who are careless and only apply for relief in times of urgency, and he will find that the *laisser-aller* cases are the ones which as a rule do badly. However, let me allow the younger Zeissl [1] to speak for himself, and he but voices the tenets of his deceased father. In his most recent paper he says: "When syphilis is treated expectantly—that is, when an antisyphilitic remedy is not given to the patient after the first secondary symptoms—the eruption requires, on an average, a period of two to eight months for its disappearance, while the initial sclerosis requires at least four months, oftener five or more, for its involution. Defluvium capillorum and enlargement of the ganglia often remained noticeable for a year; with the return of the growth of the hair the symptoms successively disappeared. Zeissl (senior) very rarely observed any relapses, especially of a severe kind, when purely expectant treatment was continued until complete disappearance of the syphilitic symptoms. We can confirm the observation from our own experience." He further states that if patients in private practice demanded rapid relief from disfiguring cutaneous affections, mercury was given to them. It seems to me that to pursue a system like the one thus called opportunistic, which can but expose the patient to trouble, danger, and disaster, is almost criminal. It has always seemed to me that this treatment, based on fantasies and assumptions, is founded upon a hopeless view of the possibility of curing syphilis, and upon a fear that the active use of mercury will be productive of

[1] "Die Gegenwärtige Stand der Syphilis-therapie," *Klin. Zeit und Streitfragen*, 1887, p. 160.

harm. I can well understand why the elder Zeissl (as it is reported) recklessly said that if a man once had syphilis, his ghost would be syphilitic. His idea of syphilitic therapy would certainly warrant that belief. The expectant or opportunistic system of treatment is utterly unscientific and perniciously dangerous, and it is well for humanity that it is growing into disfavor, disrepute, and disuse.

CONTINUOUS OR "TONIC" TREATMENT.—The continuous or so-called tonic treatment of syphilis is in reality only a modification of Fournier's system of treatment, amplified by considerable theoretical elaboration. It has had as its champion, in England, Mr. Jonathan Hutchinson,[1] who may be said to be the pioneer in the doctrine of long-continued mercurialization in syphilis. In this country my friend Dr. Keyes[2] has long been a believer in its efficacy, and he is the sponsor for a system of medication which he terms "the tonic treatment of syphilis." The therapeutical agent employed in this scheme of treatment is the protoiodide of mercury (Hutchinson uses gray powder), which is to be given without cessation for two or more years. Here is the system in the author's words: "Supposing that the centigramme granule (protoiodide of mercury gr. $\frac{1}{6}$) has been selected as the medicine to be used, the instructions to the patient are as follows: Take one granule immediately after each meal (*i. e.* three times a day) during three days. On the fourth day add one granule to the midday dose, taking one in the morning, two at noon, one at night. Continue this during three days. Again, on the fourth day add one granule—two in the morning and at noon, and one at night. Continue this for three days, and again on the fourth add a granule. Continue in this manner, being very careful as to food, drink, exposure, etc., until there is very positive evidence of irritation in the intestine, such as colicky pains with positive diarrhœa, or until the gums begin to show signs of being slightly touched.

"The daily amount now taken is known to be the patient's dose of the given preparation of mercury, beyond which he cannot go without aid from opiates, and of which, if long maintained, the effect upon the general health will be certainly damaging.

"The amount, whatever it may be, I call the full dose in contradistinction to his 'tonic dose.'

"It is impossible to find what the full dose of a patient is except by experiment. The 'full dose' being ascertained, it may be continued by the aid of opiates and unirritating food until the eruption or the syphilitic symptoms, whatever they may be, are overcome. As soon, then, as the active symptoms have yielded, the patient's dose is

[1] "When and How to Use Mercury in Syphilis," address before the Hunterian Society of London, January 8, 1874.

[2] *The Tonic Treatment of Syphilis*, New York, 1877.

reduced one-half, and this half dose, which will act as a tonic (I call it the 'tonic dose'), is to be continued unceasingly day after day, month after month, waiting for new symptoms. Should such symptoms appear (there may be none whatever except throat and mouth lesions), the half dose held in reserve (I call it the 'reserve dose') may be at once added to the 'tonic dose,' and the 'full dose' continued until the symptoms yield, after which the 'tonic dose' is to be again resumed."

I have never been an advocate of this scheme of treating syphilis. It has always appeared to me that the system is very thoroughly pervaded with theory and built upon confusing arithmetical problems. It assumes to gauge the therapeutic power of mercury by the state of the gums and of the intestines of patients taking the drug for syphilis. I do not consider these buccal or intestinal criteria of such importance or of such reliability that they should be the guiding-points in medicinal treatment. In most cases salivation can be prevented by scrupulous care of the mouth, and the patient put in such a condition that he can stand large doses of mercury, whereas while he had his buccal infirmity he suffered from sore mouth from very minute doses. So that, as a broad general rule, it may be said that the state of the mouth is not an index as to the amount of mercury the patient can take or as to its therapeutic effect on the disease. Moreover, the condition of the intestines is not in any sense a reliable guide in syphilis therapy. The mercurial taken by the stomach may cause mild or severe gastro-enteritis and have no effect upon the syphilis, and the believer in this doctrine might then think that he was at the end of his tether—that he had gauged the patient's dose and found it irritating and inefficacious. Now, let that man leave the patient's stomach alone, and administer to him hypodermic injections of mercurials or inunctions of mercurial ointment, and he will generally find that with careful management the symptoms and lesions will be made to yield without untoward effects, though he may be a little wavering in his mind as to the arithmetical quantity of mercury he has given that patient. In this case certainly the intestines are not good guides.

Then, again, a man who pins his faith on one remedy and one form of pill in the treatment of syphilis is like a man who attempts to run with a chain and ball attached to his leg. The treatment of syphilis is far from being a matter of routine or a mere problem of dose-arithmetic. To be thorough and successful, as I have said before, it must be based on broad principles, upon an accurate and full knowledge of the disease, and upon frequent and thorough study and observation of the patient. In the course of syphilis many conditions, exigencies, and complications are apt to arise, and the physician to be successful in its cure must be ready with all known modifications and expedients of

treatment. I would ask what latitude a surgeon has in the treatment of syphilis with only protoiodide-of-mercury granules, pellets, or pills at his command? In what condition is he to cope with unusual features, exigencies, or complications?

Furthermore, the fatal shortcoming of this treatment resides in the mercurial preparation itself. Though much vaunted years ago in the therapeutics of syphilis, the protoiodide of mercury has, after years of trial by many syphilographers, been found to have only a certain scope and very many limitations. It is a very excellent preparation within certain limits, but beyond them it is feeble or even inert. I have used this remedy for more than twenty years, and to-day, after careful study and observation, I am led to place little value upon its efficacy in the treatment of syphilis after the lapse of the first few months. In early secondary syphilis it may be used with decided benefit, but later on in the vast majority of cases it will be found wanting, and can be replaced with benefit by other mercurial compounds taken by the mouth or by other methods of administering mercury.

Finally, the unremitting use of the drug has its disadvantages, its drawbacks, and its dangers. We find some patients who, having a mild form of syphilis, keep on taking the protoiodide for long periods for the reason that it is easily taken. Some people can take mercury for years, and seemingly be unaffected injuriously. The drug seems to stimulate their portal system, and takes the place of saline laxatives. I very much doubt whether the mercury in many of these cases is at all absorbed into the circulation. The continuous use of mercury by stomach ingestion induces a condition of tolerance, and after a time it ceases to be a therapeutic agent, or has no effect—certainly none that is beneficial. For many years I have seen patients who have come of their own accord, or have been sent by physicians, who have been treated continuously and without any intermission whatever for two or more years with mercury, and who still have some syphilitic lesion which refuses to disappear—perhaps dermal, osseous, or articular, or even cerebro-spinal, ocular, or visceral. These patients, and very often their physicians, cannot understand why it is that a treatment so constant and seemingly energetic, and in most cases so conscientiously administered, should be productive of such unsatisfactory results.

The answer is clear and simple. They have used mercury in a weak and impotent manner in the early days of syphilis, and have continued its use long after it had ceased to have any therapeutic effect—long after it had lost its influence, when given by stomach ingestion, over the syphilitic diathesis. Strange to say, some of these patients had escaped without serious injury, but in others the chances of cure had been materially jeopardized or rendered more remote. In very many cases this incessant mercurial treatment is productive of

very bad results. I have seen most distressing instances of neurasthenia and a general undermining of the constitution, which predisposed the patient to such grave disorders as pneumonia, phthisis, erysipelas, etc., which were undoubtedly due to the debilitating influences of a long-continued mercurial treatment, which greatly defibrinizes the blood and weakens the tissues. Dilatation of the stomach (Jullien) and a low grade, or even a severe and ulcerative form, of enteritis, have (Overbeck, Heilbronn, and Mehring) been known to be caused by these continuous mercurial courses. Thus given, mercury does not cure the syphilis, which may slumber or may break forth, but it induces a low grade of health, which is fraught with trouble, danger, and disaster to the patient. I scarcely know of a more difficult task than that of curing an old syphilitic who presents more or less distressing or dangerous lesions for which he has long undergone an attenuated, low grade, and prolonged mercurial medication, which kept him on the ragged edge, and failed to dislodge his enemy. I have seen, during many years of careful observation, so much trouble, suffering, misery, and even disaster, result from this method of treatment that I feel it my duty to raise my voice against it as being unscientific, irrational, and mischievous, and a perversion of one of the greatest therapeutic blessings which we possess. It is gratifying to note that among advanced syphilographers there are very few indeed who advocate chronic continuous mercurialization. This fact has been well shown in all of the discussions at the recent great congresses of Medicine and Surgery.

The Interrupted Treatment of Syphilis.

The method of successive treatments or the interrupted treatment of syphilis was proposed by Fournier[1] in 1872, and was the outcome of a reaction against the short and vigorous six months' mercury and three months' iodide of potassium treatment which had been introduced by Ricord, which with certain minor modifications was followed by most French surgeons of those times, though some of them were contented with a three months' course. Fournier says: "I am fully satisfied of the truth expressed by Chomel, that the duration of the treatment is more important than large doses. It is a hundred times better to treat a patient for a long time with sufficient doses of mercury than within a short time to give him large doses. This point, however, is scarcely open to dispute, for it is certain that in order to derive all the good which mercury can give, and to avail ourselves of its *curative* influence *for the future*, it is necessary to administer it for a longer time than is generally laid down." Fournier recognized that when given over long

[1] *Leçons cliniques sur la Syphilis, etudiée plus particulierment chez la femme*, Paris, 1881, p. 782, *et seq.*

periods mercury loses its efficacy, and says: "It is the same with mercury as with other remedies: its continuous use induces a condition of tolerance which lessens and finally destroys its therapeutical effect. Now, what interpretation more simple or rational can be given to the fact, which every observer has seen many times, than that a certain dose of mercury, having exerted an influence on the disease for a certain time, beyond that has lost its influence because the organism has become *habituated to it?*" He therefore advised, in 1872, that over a period of two years mercury should be given for a time, and that then it should be stopped for a certain time, during which the patient becomes unaccustomed to the remedy. By so doing, he says, "I should preserve the peculiar intensity of action of the mercury during the whole period of treatment."

He then continues: "The second intention of this method is to confer upon patients the advantages of a long-continued treatment, and this method is better adapted than any other to this essential indication. In fact, it enables patients to be treated for a long time without wearying them, and to take for as long a period as may be necessary a remedy which, if continuously administered, would not be long either in being not tolerated or in losing its curative action."

Before giving a brief outline of the main points of Fournier's system of mercurialization in syphilis I feel that I shall be doing much good service, particularly to the younger members of the profession, by quoting in full Fournier's graphic, eloquent, and in every way admirable exordium as to the necessity of treating syphilis (which, by the way, is one of the most trenchant passages in syphilographical literature), for the reason that some may be led astray by the specious, sophistical, and pernicious doctrines of the opportunist or expectant school. He says: "Is it or is it not necessary to treat a syphilitic patient? Is it or is it not beneficial that he should be treated? In order to answer a proposition thus stated, let us consider what risks such a patient runs, by stating his condition clearly. To what dangers, in fact, is he exposed? Let us set forth his pathological balance-sheet, if I may speak thus—a balance-sheet which if not certain and inevitable is at least probable and possible. What can such a patient have? What lesions is he liable to develop some day or other? And these lesions, are they of such a character that it will be urgent or advantageous that they should be treated? What he can have are at first lesions without any real gravity, but which are at least very disagreeable to some, particularly if they are visible: thus he may have cutaneous syphilides of various forms, very annoying syphilides of the mucous membranes, engorgements of the ganglia, alopecia, and onyxis. In the second place, there are more serious lesions, from the fact that some of them are very painful: they are angina, cephalalgia, various

pains with nocturnal exacerbations, insomnia, myalgia, pain in the joints, inflammation of tendons, periostitis, etc. Should not the possible anticipation of such troubles justify the intervention of treatment? But we have really a third order of lesions, which are much more serious, and which may involve and compromise important organs. Only to cite the most common of this group, we shall find affections of the eye, such as iritis, choroiditis, and retinitis, which are capable of impairing or even extinguishing vision; sarcocele, which may induce disorganization and atrophy of one or both testicles, and thus produce impotence; gummy tumors, which often perforate and destroy the velum palati and leave a double and revolting infirmity; paralyses of the eye and face; hemiplegia and paraplegia; inflammation of bone, caries, ozæna, flattening and loss of the nose, without speaking of the possibility of hereditary transmission and of the introduction of syphilis into the family circle. But this is not yet all. If we consult a manual of pathological anatomy we shall find there described fatal lesions attributable to syphilis alone. The causes of death in syphilis are many and varied: death by hepatic lesions, cirrhosis, and hepatitis gummosa; death by lesions of the meninges; by cerebral gummata and syphilitic encephalitis; by lesions of the spinal cord, which are more common than is generally believed; by exostoses of the cranium and vertebræ; by lesions of the kidneys, of the larynx, and of the lungs, and more rarely by lesions of the œsophagus and rectum; death by consumption and progressive cachexia. These are, in short, the possible consequences of syphilis, and such is the perspective offered to a person who contracts this contagion. Dare we call a disease benign which can end thus? Can a disease be called benign which is fraught with such serious accidents and whose pathological anatomy is so rich and varied? Dare we tell persons afflicted with this disease to leave it untreated, to let things go, and to wait patiently the possible results of such an infection, without warning them of it?"

Certainly nothing further need be said as to the duty of the physician in the treatment of syphilis.

Fournier's method of treatment, concisely stated, is as follows: He begins by administering from three-quarters to one and a half grains of the protoiodide daily in divided doses. In three or four weeks the eruption will in all probability have disappeared. The treatment, however, is prolonged for two months. (That is, the patient is put under treatment in the primary stage and mercury is given for eight weeks.) Fournier then says: "After that, what shall I do? After that, *whatever may happen* (bear this well in mind), I would suspend treatment, being very certain from experience that my patient will have already become accustomed to the mercury, of which continued doses would only have a relatively small effect. I would leave him without treatment for

several weeks; to be more definite, at least a month. That time having elapsed (understand this well also), I would recommence the treatment, whatever might have happened; whether the patient has or has not had new lesions, he would be none the less syphilitic nor less liable to the manifestations which it is my desire to prevent." The renewed treatment should last six weeks or two months, and then a respite of three months is granted. Then mercury is given again for six, seven, or eight weeks. Then a suspension of several months, until at the end of two years a patient has taken mercury for ten months, and has at intervals been without it for fourteen months. This treatment, introduced in 1872, has been adopted by many, and has been attacked violently by a few, notably by Diday, against whose therapeutics Fournier directed much incisive logic and many facts. It evidently has not fulfilled the expectation of its originator, for we find that within a few years Fournier[1] writes: "Syphilis is an infectious chronic constitutional disease, diathetic like gout and scrofula, and should have a lifelong treatment." So in 1889 he says that in the third year there should be four courses of six weeks each with respites of equal length, and that iodide of potassium should be taken. In the fourth year four similar courses of six weeks' duration, and in the fifth year three courses. We also find that Martineau advocated a five years' course, while Besnier says that it should be indefinite, and Leloir has recently put forward a system of treatment of four or five years' duration. Indeed, there seems to be in France a prevailing belief among many that syphilis is an incurable disease, such a statement being the keynote to a series of clinical lectures by Denis-Dumont, published in 1880.[2]

For many years I was an advocate of the plan proposed by Fournier for the treatment of syphilis, and I had the pleasure of first presenting his views in the English tongue.[3] But as years went on I found that although the general plan is an excellent one, the treatment as a whole is very defective. The objections to it are mainly those which I have detailed in the section on the continuous treatment by mercury, which is really only Fournier's treatment kept up without cessation, and is even more defective and inefficacious than the latter.

As a general working plan, however, Fournier's system has much to commend it, though I am free to say that I can only condemn its essential feature—the protoiodide of mercury as the therapeutic *pièce de resistance* and the general arrangement of treatment in the primary and early secondary stages. For very many years I have studied this

[1] "Direction générale du Traitement de la Syphilis," *Gazette des Hôpitaux*, Nos. 103 and 107, 1889.

[2] *De la Syphilis: unité d'origine; incurabilité; traitement*, Paris, 1880.

[3] "On the Treatment of Syphilis," by Alfred Fournier, M. D., translated by R. W. Taylor, M. D., *New York Med. Journal*, Aug. and Sept., 1872.

question carefully, closely, and conscientiously, having at my command a vast clinical field; and in the light of knowledge already gained, and of what I learned from my successes and my failures, I have arrived at conclusions which embody, I venture to think, a most effective and practical system of treating syphilis—one which in the great majority of cases will eradicate or suppress the disease and restore its victim to health. In this treatment there is nothing particularly new and startling, and in its essential points I have the support of many of the ablest continental authorities. My observation from year to year has thoroughly convinced me that the current emasculated, theoretical systems of treating syphilis are dire failures and bring very many patients to discomfort, suffering, disaster, invalidism, and death. While some may get through by reason of some lucky chance, I feel very certain (and I make this statement after due thought and observation) that a man in the long run will have a far better chance to be cured of his syphilis by the old-time vigorous six-months' mercury and three-months' iodide treatment than he will by the long-spun-out, attenuated courses which have as a watchword the phrase pregnant with ignorance and complaisant indifference, that time and mercury will cure or wear out syphilis.

The General Methodical Treatment of Syphilis.

We have already seen that, for very cogent reasons, it is best to wait until the onset of the secondary period before beginning a general antisyphilitic treatment. If the patient is under observation during the course of the chancre, much can be done for him in advance by the surgeon. At this time he can be prepared, if necessary, for the coming ordeal by a preparatory tonic course, or if there are indications of gastro-intestinal impairment or debility, measures to remedy them may be instituted. Then, again, in this period, if there are very much swollen lymphatics or ganglia (and they will be found in association with the chancre), a well-directed external regional treatment may be followed. To this end mercurial plasters, such as emplastrum de Vigo, or Unna's and Quinquaud's plasters, or simple mercurial ointment, may be used. This regional treatment will have no perceptible effect upon the general deepening of the infection. At this time also the condition of the mouth, gums, teeth, and pharynx should be inquired into, and these parts should be put as nearly as possible into a condition of health.

Before putting a patient upon general antisyphilitic treatment it is well for the physician to place before him certain facts as to his condition and his duties, and to forecast for him, as far as possible or prudent, his future pathological balance-sheet, so that he may know clearly what he has to do, what he has to fear, and what he may expect. With

the onset of secondary syphilis a most important and eventful epoch in the life of the patient begins, and much can be done for him by a little kindliness and common sense. The physician must impress upon the patient the fact of the gravity of his disease and prepare him for the ordeal which is in store for him. He must be made to understand, in a gentle, kindly manner, that the ensuing two years at least are the most critically momentous ones in his whole life, and that his future health and happiness and those of his family depend upon his care of himself during this trying epoch. It is cruel and unnecessary to paint a dismal and lugubrious picture to these patients, or by word or manner to depress or discourage them. We are in the position, thanks to our advanced therapeutics, to speak encouragingly and even brightly of their future, and to hold out to them the assurance that the ordeal of treatment will not be irksome or painful, and that a future cure is in store for them. We can tell our patients truthfully that two or two and a half years of careful, methodical, watchful treatment are, if they will conform to its regulations, sufficient to cure them of their disease. As a result of the treatment they will see the syphilitic lesions cease and fail to return, they will enter into a period of health in which there are no signs whatever of syphilis about them, and they will thus remain and will possess the power of procreating healthy children. The requirements for this gratifying state and for this future immunity are a fairly good state of health previous to infection, the docility and loyalty of the patient to his physician, and a treatment begun sufficiently early and carried out in a watchful, thorough manner. This is the tripod upon which his future happiness rests. In the treatment of syphilis the duties of the physician and patient are reciprocal. While, therefore, in the majority of cases, particularly those of the intelligent and well-to-do classes, we are warranted in giving a hopeful and satisfactory prognosis, there are cases in which, under the best of circumstances, the progress toward cure is slow, often disappointing and halting, and attended with much suffering, discomfort, debility, and illness. But even in these cases, trying and often discouraging alike to the patient and the physician, there is usually no necessity for doubt or despair, since with the rich therapeutic armamentarium at our command we are enabled to adapt ourselves to urgent necessities, exigencies, and emergencies, and even to cope with formidable crises. In his early interviews with a syphilitic patient it is the duty of the physician to make a careful study of the man, to acquaint himself with his temperament, his standard of health and vitality, his greater or less power of resistance to disease and bodily strain—in fact, his mental and physical stamina, modes of life, tendencies, habits, surroundings, and his duties, obligations, cares, and responsibilities—since from such a study much valuable knowledge is gained.

It must always be remembered that weakly, cachectic persons of poor fibre; flabby subjects; those who may be classed generally as under-weight individuals; persons of very light and sandy complexion; those suffering from rheumatic, gouty, tuberculous, neurotic, malarious, or other adynamic conditions or influences; those having visceral disease of any kind or any inherited or acquired morbid tendency, and particularly persons addicted to alcoholic indulgences,—are liable to suffer more or less severely from syphilis, and that in such cases the prognosis is less favorable and a longer time for cure may be required.

Besides its lesions proper, syphilis tends in many cases to produce in the economy anæmia, cachexia, and even a condition of marasmus. Though there are some patients in whom it does not produce debility, and who, despite their disease, seem as well as they ever were, we must always be on the lookout for its depressing effects upon the system. Therefore the first rule to be laid down in the treatment of syphilis is that the hygiene, regimen, and surroundings of the patient shall be made as nearly as possible perfect. The diet must be simple, ample, and nourishing, and the patient's habits as to eating, drinking, and sleeping should be regular and systematic. All health-giving sources of recreation and exercise should be made use of, and every attention should be given to maintaining the health and vitality of the patient at as high a plane as possible. Therefore patients must be warned against overtaxing themselves physically or mentally, or in any way putting themselves on a strain. The physician should always be watchful, particularly in the treatment of patients of the higher classes, about the mental wear and tear that so many are liable to. In such cases syphilis is very prone to produce cerebral and mental disturbances.

While in general abstinence from alcoholic drinks is to be recommended for syphilitic patients, it is always well to exercise wholesome common sense in dealing with this question. Many authors go to an extreme in considering that syphilitics should become prohibitionists. The ordeal of the syphilitic is not as a rule a very happy one, and the less we surround him with irritating restrictions the more docile will he be in the long run in following treatment. Therefore I think that a man who by habit partakes moderately of claret or burgundy or other mild stimulant at his chief meal, and who enjoys it and is seemingly none the worse for it, should not generally be deprived of it. Then, again, there are patients who partake in moderation of ale and beer, and who are to their thinking benefited thereby. Provided these stimulants do not disorder the stomach, they can hardly be called deleterious; therefore their use should not be abruptly interdicted. On the other hand, indulgence in strong alcoholic drinks and champagnes must be peremptorily stopped. Nothing is more galling to patients, according to my experience, than a tread-

mill treatment which surrounds them with all sorts of restrictions and imposes upon them blue-law abstinence. The plan which works best in the long run in handling syphilities is that which, compatible with their well-being, gives them most latitude and revolutionizes their habits and modes of life as little as possible. To sum up, alcohol should only be used by syphilitic patients in great moderation and under conditions which tend to improve their strength and digestion.

It is almost unnecessary to say that excessive sexual indulgences are depressing and exhausting, and that they are to be wholly avoided. Very many cases of cerebral and nervous syphilis have their origin in sexual excess, and many men have become infirm or have perished from such over-indulgence while in the power of syphilis. As to tobacco, we can hardly speak with the same latitude and tolerance as we can of alcoholics in syphilis. Smoking and chewing, even in mild indulgence, are so prone to induce irritation and inflammation of the mouth and throat, parts which it is so vitally necessary to keep in a high state of health, that we are forced as a rule absolutely to prohibit them. It requires, very often, considerable moral courage to deny the touching appeal of a patient to be allowed one or two cigars a day, but we must in general stand firm. Still, there are cases, happily for them, in which, despite syphilis and its treatment, irritation of the mouth and throat does not exist, and such patients may perhaps, under observation, indulge their favorite habit. Wherever the use of tobacco produces even mild hyperæmia of the mouth and throat it should be firmly forbidden.

All functional derangements or affections of internal organs, stomach, intestines, liver, spleen, kidneys, etc., should be carefully attended to. Patients prone to pulmonary affections, and those having a tendency to rheumatism and gout, should be warned in advance to observe very great care in the avoidance of the causes which are liable to light up or develop these dormant tendencies. In like manner, neuropathic subjects, and those suffering from any hereditary or acquired cerebral or nervous trouble, should be made carefully but impressively to understand that the nervous system is their weak part, and that while they are in the grip of syphilis they must be more than ordinarily careful not to overtax it or to abuse it.

It is very important that the changes of the season and weather should be accompanied with appropriate clothing, and that the utmost precaution should be taken against catching cold.

While the physician should thus impress his patient with the gravity of his condition, he should also constantly hold out to him that most consoling hope, that he will, in all probability, in the end be free from his disease. While some patients are calm and sensible, and others

light-hearted and indifferent to their physical condition, others, again —happily not many—show a tendency to worry, fret, and solicitude, or even to a depression of spirits and melancholy which is termed syphilophobia—a most distressing state of mind both for the patient and his physician. Such cases should be treated with constant encouragement and kindness mingled with firmness; their doubts should be dispelled, their fears should be allayed, and bright hopes should be held out to them. By such a course many a rough spot will be made smooth, and many a man will be auspiciously brought through his syphilis who otherwise would have faltered or have fallen by the wayside.

With the onset of the generalized manifestations of syphilis at the beginning of the secondary period the regular methodical treatment should be commenced. At this time and at short intervals thereafter the patient must be carefully examined as to the condition of his skin and its appendages, of his mouth and throat, and lymphatic system generally. Taking for an example a case of roseola with its usual concomitants of slight fever, malaise, and perhaps nocturnal headaches or rheumatoid pains, we should immediately put the patient, as a general rule, upon treatment by the mouth. Later on the inunction method may be employed, but as a rule pills are quite effective, particularly in the very early secondary stage. While intelligent patients will usually submit gracefully to inunction treatment later on, its adoption at the very outset is apt to be irksome, and to give them the idea that they have a very trying and unpleasant ordeal before them. Though many preparations of mercury are employed, my preference is for the protoiodide and the tannate when the drug is given in pill-form. Calomel and blue pill are usually not satisfactory agents. Calomel is very apt to salivate promptly, and its action is far from certain; and as to blue pill, it may be said that when given in small doses it does nothing for syphilis, though it may act upon the liver, and when it is given in sufficient quantity one never knows how soon severe salivation may be induced. Bichloride of mercury is given by some physicians in pill-form, and is the active ingredient in the Dupuytren pills so much used in France, but it is very apt to produce pain in the chest and bowels and gastro-intestinal irritation. Then, again, its action cannot be relied upon, for in small doses by the stomach it does little if any good, and in large doses it is very irritating. Its action when used hypodermically is, however, very efficient and satisfactory, and its local action in lotions and ointments is very prompt and beneficial. Within recent years the carbolate, salicylate, thymolate, alanilate, and other preparations of mercury have been vaunted as possessing marked potentiality, but when put to the test they give evidence of possessing no advantage over the drugs I have named. In

the section of this essay upon hypodermic injections all the new compounds are treated of.

Since every case of syphilis is a law unto itself as to the amount of mercury which will be required for its cure, we can only state the doses approximately. For an adult, male or female, a quarter or a third of a grain of the protoiodide of mercury may be given at a dose, of which three a day will be sufficient. Very large and robust persons may require one half of a grain at a dose. These are always good doses to begin with, and by them the tolerance of the drug may be ganged and its remedial action estimated. I have elsewhere in this essay called attention to the very minute doses of the drug given by some physicians, but it is appropriate to repeat here that the one-fifths and one-sixths of a grain of the mercurial preparation recommended by some are merely child's play for most cases of syphilis.

In the early secondary stage there are certain conditions favorable to an active treatment—namely, a system virgin to mercurial action and a greater susceptibility of the lesions to the action of mercury. This, then, is the most favorable time for efficient treatment, and it is the most critical one in the life of the syphilitic, for if the disease is actively attacked then, its backbone may be broken. It is very probable that much of the late rebelliousness and malignity of syphilis is due to the fact that the newly-formed infecting granulation-cells and the concomitant subacute inflammation induce in organs and tissues, particularly delicate ones, structural and nutritive changes which predispose them to subsequent low grades of inflammation and cell-increase; besides, to a repetition of the essential syphilitic process. Therefore every effort should be made to destroy these young infection-cells, and to remove them as quickly as possible from the parenchyma of organs and tissues, before they shall have had time to induce these subtle and dangerous structural changes. In proportion as a systematic and vigorous mercurial course is entered upon late, so it is more and more heavily weighted in its action. There is no doubt whatever in my mind that a mercurial treatment covering the first six months of the disease is far more salutary and effective than a course extending over a year and more, instituted later on.

It is important, therefore, that the initial course should be active and prolonged, and in attaining this end the case must be carefully handled and watched. As a rule, the physician can form a correct estimate as to the probable effect of mercury upon his patient within a week or ten days. Having put the stomach and intestinal canal in normal condition, and the mouth and throat having received proper attention (see section on Stomach Ingestion), the dose of the mercurial may be increased within a few days to one grain or one grain and a half, and even to a larger quantity. It is rarely necessary to give more

than three grains of the protoiodide in a day, and most cases will do well with about two grains, or even less. The tannate of mercury is a very active drug, which from a large experience I have come to place much confidence in. It is not as mild as it has been claimed to be, and cannot (as has been implied) be used with impunity. In some cases it causes gastro-intestinal irritation, and in my early days of its trial I saw several cases of prompt and severe salivation. Its initial dose is best fixed at one half a grain, instead of a grain, as recommended by some. In combination with the mercurial preparation we may employ a ferruginous or bitter tonic, and as an adjuvant we may add a sedative agent to calm the intestinal canal. I think a note of warning should be raised against the combination of preparations of opium in antisyphilitic remedies. There is really no need for them, and much harm may be done by their continued use in producing an habituation to the drug, with all its deleterious effects upon the nervous system, the digestive organs, and the tissues generally. We can never determine the exact condition of a patient under mercurial treatment who is also under the influence of opium. As a general rule, in stomach ingestion mercury, if carefully given, causes little trouble. It may produce diarrhœa and colicky pains for a day or two, which a little essence of ginger or peppermint will relieve, or it may be necessary to omit one or two or more doses. In general, if patients are careful about their food and do not take too much fluid into their stomachs, the mercurial will after the first disturbance cause no irritation.

The following formulæ may be used:

℞. Hydrargyri protoiodidi, gr. viij to x;
Ferri et quinin. citrat., ʒiss;
Ext. hyoscyami, gr. vj.—M.
Ft. pil. xxx.

℞. Hydrargyri tannici, gr. xv to xxx;
Quinin. sulph., ʒj;
Ext. hyoscyami, gr. vj.—M.
Ft. pil. xxx.

The protoiodide may also be used in the form of tablets, and the tannate is put up in gelatin-coated pills. As I have said elsewhere, the protoiodide of mercury is a rather feeble preparation, and its use is most effective in the early months of syphilis, though in later periods it may be employed if we desire a mild mercurial action. When we administer it in the initial course of treatment we must watch its effects very carefully, otherwise we may waste most valuable time. I am firmly convinced, from ample experience and conversations with physi-

cians, that since the adoption of the long mercurial courses with minute doses an easy-going, happy-go-lucky feeling has taken hold of many of them in the treatment of syphilis. They are told, in some of the books and at some colleges, that with doses of fifths and sixths of a grain of the mercurial salt syphilis may be cured in two or three years, and this, practically, is the extent of their therapeutic armamentarium. This teaching, I know, has engendered a feeling of false confidence and security and a tendency to superficial and dangerous routine. The physician complacently satisfies himself that his arithmetical dose is all right, and he contents himself with the thought that time and mercury will wear out syphilis, and that all will be well in the end. Under these conditions the patient is largely lost sight of, and the abstract problem—syphilis—is uppermost in the physician's mind. The cure of syphilis can only be accomplished by constant care and watchfulness on the part of the physician, who should feel his way, should push his remedy cautiously, and keep it so well in hand that he will get all of its good affects and avoid all drawbacks and harm which may arise if they are not looked out for.

The criteria which indicate that our treatment is correct and efficient should be carefully studied. If the patient looks and feels well, sleeps soundly, eats heartily, holds his accustomed weight, and is mentally and physically in a satisfactory condition, there is strong evidence that he is being benefited. But we must further assure ourselves that the lesions are being acted upon. The indurated nodule must have wholly disappeared, the lymphatic engorgement must show evident signs of involution, and the rash must have faded. The throat and mouth must be inspected very often, and any red patches or ulcerative lesions must be actively treated. It is always a good rule as the rash is declining to discontinue the pills and to give the patient one or two courses of mercurial inunctions (see section on Inunctions), by which the whole surface of the body will be acted upon by mercury. In this way any infectious cells which may be left over from a local or general rash may be acted upon and destroyed. Even while the patient is taking pills mercurial ointment may be used locally upon the lymphatic ganglia, due care being taken that an overdose is not given. In like manner papular and pustular lesions in hairy parts should be treated locally. The physician should always remember that all syphilitic lesions, even the most minute, are to be feared as possible sources of continuous or intermittent reinfection of the system. The morbid cells contained in these lesions are capable of great, even infinite, multiplication, and the so-called syphilitic relapses are due to the recurrence of these cell-proliferations, which develop from morbid foci left over at an earlier date. Painful spots and swellings upon bones or near or at joints, thickening of the fasciæ and subcutaneous con-

nective tissues, should receive regional treatment. In like manner, in cases of headaches, neuralgias, rheumatoid pains of muscles, eye and ear affections, affections of the hairs and nails, the mercurial action should be brought as near as possible to the morbid area. It is also advisable to watch for and act promptly upon red scaling patches and papules seated upon the palms and the soles, since they are very persistent. Any swellings and hyperplasiæ about the mouth or face, vulva, anus, and scrotum should receive careful local treatment. As time passes, in some cases it will be seen that even with full doses internal mercurial medication is feeble and more or less ineffective. If the case is carefully watched this will be promptly discovered, and the patient may be put upon inunctions, fumigations, or hypodermic injections. It is a good rule never to be content with the action of mercurial pills unless we see a decidedly rapid subsidence of the lymphatic ganglia. It must not be forgotten that the action of the protoiodide, the tannate, and other mercurial preparations grows less pronounced as time goes on and the infecting cells become more stable and hardy. This fact being evident, it is necessary to substitute another method of administering mercury.

Our aim should be to keep up a continuous mercurial action during from four to six months after the onset of the secondary stage. In general, this can be done without experiencing any serious drawbacks if the case be properly watched. There may be periods of a few days in which it is necessary to suspend medicine and either leave the stomach at rest or give tonics. But as a rule this early period offers us our golden opportunity, and we should always avail ourselves of the then existing favorable condition of the stomach and the system to assimilate mercury. In somewhat rare cases mercury taken by the stomach acts as a general depressant and the patient's nutrition is impaired. I have many times seen these grave drawbacks and seeming contraindications promptly dispelled by the employment of hypodermic injections of the bichloride of mercury. In such cases it is well to begin with a moderate dose, and then work upward as fast as we can.

During this initial active and energetic course we must take especial care of the patient's nutrition and be watchful of his well-being. If possible, change of air and scene at the seaside or the mountains should be enjoyed and as much recreation indulged in as possible. The lighter the patient's cares and the less burdensome his condition of life, the more auspicious will his progress toward cure be.

While a patient is undergoing this mercurial course he should have one or two warm baths each week on going to bed, in order to produce diaphoresis. When practicable he should take Turkish baths, without the cold plunge, and after them should be made to sweat freely. At

the seaside cold salt-water baths are very beneficial, and an occasional hot sea-water bath, followed by packing and a sweat, is a valuable adjuvant to mercurial treatment.

In cases, particularly uncomplicated ones, well treated from the beginning there are usually no perceptible secondary or tertiary stages. The secondary stage is entered upon, the disease is systematically attacked, and, excepting, perhaps, a few ephemeral and trifling manifestations upon the skin or mucous membrane (and they are largely produced by extraneous irritation, friction, coaptation of parts, want of cleanliness, smoking, etc.), he or she sees no further development. Still, some cases are rebellious, and tax our resources and patience, and some—happily few—go badly from the start.

Early in the secondary period in some cases it is necessary to resort to the use of iodide of potassium, sometimes alone and again in combination with mercury. As a rule, these cases are anomalous ones, in which certain lesions show a tendency to early and precocious development. The early onset of cerebral symptoms, some forms of headache, dementia, mild mania, epilepsy, hemiplegia, paraplegia, and aphasia call for the vigorous use of the iodide in combination with inunction-treatment, which should be used upon the neck and upper part of the body. The early supervention of osseous and articular lesions, the occurrence of epididymitis or orchitis, precocious affections of the ear and eye, and swelling of the spleen and liver should all be combated with a combined iodine and mercurial treatment. In like manner, the precocious development of cutaneous gummata and gummatous infiltration into mucous membranes (particularly of the mouth and pharynx) indicate the necessity of local mercurialization when practicable and the internal use of the iodide of potassium. With these exceptions the use of the iodide is absolutely to be condemned in early and secondary syphilis, for reasons given elsewhere.

It may be stated as a broad general rule that when cases come under treatment after the disease has existed for several months, they should be placed at once upon the inunction method. This course is particularly to be followed when the patient presents a more or less general eruption. In these cases we very often cannot bring sufficient mercury to act upon the surface of the skin through the medium of the blood-circulation, and it is a waste of time and effort to make the patient swallow pills. In all cases in which treatment is begun rather late the physician should be particularly careful to try, as far as possible, to exert a prompt and efficient influence upon the disease, and to keep up the treatment for (as a rule) six months without much interruption. In this way he may be able to make up for lost time, which, I cannot too often repeat, is so vitally valuable.

While in general the initial course of treatment, occupying six

months if possible, should consist mainly of medication by the mouth or by inunction, the physician should be watchful of all complications and developments, should be on the lookout for all drawbacks and dangers, and should be ever prompt and ready with such modifications of treatment, such expedients, and such reserve resources of aid as the case may demand.

Having administered an efficient treatment, with few and short interruptions, for about six months, it is safe to say that in most cases, particularly uncomplicated ones, the patient will be well on his way to recovery. I have very many times seen patients who, for various reasons, had, many years before, undergone but one thorough mercurial course of six months, and who thereafter had been entirely well, had never shown any further evidence of syphilis, and who had procreated perfectly healthy children. Cases like these convinced me of the great efficacy of early thorough treatment, and I am glad to see that several eminent continental authorities have reached the same conclusion. As I have said before (and the repetition is pardonable), a man's chances of being cured of syphilis are, in my judgment, a hundredfold better and surer by means of a single thorough early treatment of six months' duration than they are by the long-spun-out, ready-made, and emasculated method of small and continuous doses.

If the condition of the patient is satisfactory, as shown by the absence of all lesions, by almost entire subsidence of the lymphatic ganglia, by a good condition of his nutrition and strength, and by the absence of symptoms pointing to nervous depression and debility, at the end of six months he may have a rest, the moral effect of which will be very salutary. Patients very often weary of the long-continued dosing, and in the interval of repose they cease to consider themselves sick, and have an opportunity to judge of their condition when they are free from the effect of drugs. Therefore, a month's cessation of medication should be granted, and, if possible, the patient should go to the seaside or the mountains and have an entire change of air and scene. It is not uncommon, however, to see patients who do not desire a period of freedom from medication, but persist in carrying on the treatment.

According to the old-time Ricord plan of treatment, the six-months' mercurialization was followed by a three-months' course of iodide of potassium. Under proper conditions this course may be followed in those cases in which the patients are unusually anxious about themselves, and, as they usually express it, "do not want to lose valuable time." But in general my preference is to begin, after about a month's interval, a systematic inunction course. In cases in which this is impracticable or for any reason contraindicated, I have come to look with much favor and confidence upon a combination of a full dose of mer-

cury with a small dose of the iodide of potassium. The following prescription will illustrate my meaning:

℞. Hydrarg. biniodidi,	gr. ij to iv;
Potassii iodidi,	ʒss;
Tr. cinchonæ comp.,	f ʒiiiss;
Aquæ,	f ʒss.—M.

Sig. One tea-spoonful three times a day, an hour after eating, in a wine-glassful of water.

In this combination the mercurial is the efficient agent, and the iodide simply serves the purpose of rendering it soluble. When there is debility the fluid extract of coca may be added to this combination. As shown elsewhere, this agent is a very valuable adjuvant in the treatment of syphilis. From a wide experience I have convinced myself that this combination of mercury and iodide of potassium is particularly efficient and beneficial after the sixth or eighth month of the secondary period, particularly in cases which have been previously subjected to treatment. This combination is usually well borne by the stomach even when the maximum quantity of the biniodide is ordered. But great care must be observed in its administration, and if gastro-intestinal irritation is produced, the dose must be made smaller; and if a depressing effect upon the general nutrition or upon the nervous system is observed, the remedy must for a time be suspended. In these cases rest and change of air and scene are very beneficial.

The second course of treatment may be kept up, with or without slight interruptions, for three or four months, or even longer if the patient shows no signs of deterioration of health referable to the treatment. During this second course inunctions also may be used, with proper spaces of rest, or fumigations may be employed, according to the indications of the case. There may be circumstances present which render a course of hypodermic injections of sublimate preferable. In this way the first year passes, during which the patient will have been under dosage treatment nine or ten months.

Toward the end of the first year, if not before, combinations of mercury with iodide of potassium in quite large doses are very often most beneficial. The use of these combinations is generally known as the "mixed treatment." The following prescriptions are of much value:

℞. Hydrarg. biniodidi,	gr. j–ij;
Potassii iodidi,	ʒss–ʒj;
Syr. aurantii cort.,	f ʒiij;
Aquæ,	f ʒj.—M.

Sig. One tea-spoonful three times a day, an hour after eating, in a wine-glassful of water.

℞. Hydrarg. bichloridi, gr. j–ij–iij ;
Potassii iodidi, ℈ss–℈j–℈iss ;
Tr. cinchonæ comp., f℥iiiss ;
Aquæ, f℥ss.—M.

To be taken in the same manner as the foregoing.

The combination of the inunction-treatment with iodide of potassium taken internally is often very beneficial indeed, and should be remembered in late secondary and tertiary lesions, particularly when localized to certain regions, which should be acted upon directly by the mercurial ointment. The simultaneous employment of hypodermic injections of a mercurial salt with the ingestion of iodide of potassium is sometimes productive of prompt and marked benefit. As a general rule, the foregoing combinations are very useful toward the end of the first year of syphilis, but in many cases having an unusual course, and chiefly those in which late lesions appear precociously, it may be necessary to resort to them at an earlier date. It is always necessary to watch the condition of the stomach when the mixed treatment is being employed or when large doses of the iodide are administered. As soon as signs of gastric irritation show themselves the remedy must be suspended, and, if necessary, symptomatic treatment should be adopted. The iodide alone or in combination may act as a depressant upon nutrition and upon the nervous system. In these cases it may be necessary to reduce the dose or to intermit the treatment.

Late secondary and tertiary lesions of the skin and mucous membrane, affections of the bones, periosteum, and joints, late-appearing affections of the eye, ear, and cerebro-spinal system, of the viscera, and of the testes and penis, require a combination or mixed treatment. In many cases it is necessary to increase the dose of the iodide far beyond those already mentioned.

It must be remembered that the arbitrary rule laid down by some authors, that early in syphilis mercury is indicated, and that later on the iodide alone should be given, is not, in general, a good one. Many a case of tertiary syphilis has remained unaffected by the use of the iodide alone, and has promptly improved and soon recovered after mercury also was given. The use of mercury, therefore, should not be limited to the secondary stage, but should also be employed in tertiary syphilis, either by inunction or hypodermic injection, combined with the iodide given internally.

It will be generally found that patients who have followed a systematic and thorough course of treatment during the first year very rarely present tertiary lesions. The cases which present these graver disorders are usually those which have been the subject of complications in the secondary stage, or those in which an early efficient treat-

ment has not been followed or has been indifferently followed. Patients presenting tertiary lesions should be actively treated, but at the same time close attention must be paid to their general condition, for in many of them nutrition is impaired and a condition of cachexia exists.

In the carrying out of the methodical general treatment of syphilis in the second year of the disease the periods of dosage may, on an average, be stated at two to three months, with intervals of rest of a month or six weeks. In this way about eight months are occupied by actual medication. In most cases at the end of the second year of thorough treatment patients may be pronounced cured, provided they have not for many months shown evidence of the disease, that their lymphatic system appears healthy, and their general health and nutrition are good. Though there is a disposition on the part of those who rely chiefly on mouth-medication to extend the treatment of syphilis indefinitely, as I have already shown, I see no reason whatever for altering the opinion that I have many times stated, that if an energetic and thorough treatment (such as I have sketched) be followed for two years or two years and a half, the patient will be cured, as shown by the enjoyment of good health, by freedom from all syphilitic manifestations, and by his or her ability to procreate healthy children. In some cases this auspicious result may be the outcome of treatment by pills, but in most it will only be attained by the zealous and intelligent employment of inunctions, supplemented by other methods and by the use of the iodide. In the sections upon Methods of Treatment and upon Special Local and Regional Treatment further information may be found.

There are four classical methods of administering antisyphilitic remedies: first, by the mouth, or stomach ingestion; second, by inunction; third, by fumigation; and fourth, by hypodermic injections. In addition to these specific methods, there are many adjuvant and accessory modes of treatment, which have for their object the general improvement of the economy and the production of a condition in which the antisyphilitic remedies will be better borne and attended with a greater and more salutary potentiality. In the latter categories we may mention baths of various kinds, massage, the hygienic influences of change of scene and climate, and various tonic and stimulant courses of treatment.

Treatment of Syphilis by Means of the Mouth, or Stomach Ingestion.

This method is one very largely, and by some exclusively, used, and it has a quite broad scope, but also many drawbacks and limitations. Antisyphilitic remedies administered by the mouth (and these are composed mainly of mercury and iodide of potassium, used singly or in

combination) consist of pills, granules, tablets, capsules, powders, and of liquid preparations of various kinds.

As we have shown in preceding pages that these two agents possess decided therapeutic effects, we must now consider their drawbacks and the accidental and toxic effects to which they may give rise.

Mercury administered by the mouth may cause gastro-intestinal disturbances and dyspeptic symptoms of various degrees, ptyalism, stomatitis, and salivation, and a general depression and impairment of nutrition. It is well to remember that inunctions and fumigations may also give rise to similar depressing and annoying conditions, and that the hypodermic use of mercurial preparations is also attended with these drawbacks in greater or less degree, according to the particular agent used and the extent to which it is employed.

The most common form of disturbance due to the ingestion of mercury is a mild form of enteritis, which is attended with colicky pains, borborygmus, and diarrhœa. In many cases this condition is very ephemeral and passes away of itself in a few days, during which the system is becoming accustomed to the action of the drug. The pain and disturbance are felt shortly after taking the dose, and last for an hour or more, and then pass off, to follow in like manner the next dose. In other cases the effect is more severe and lasting, and the patient suffers and becomes weak. To remedy and prevent this untoward action of mercury, the utmost care must be exercised in the matter of diet, which should be bland and easily digestible, and in the avoidance of large quantities of fluids and of alcoholic and malt liquors. In very many books the advice is given that the mercurial should be combined with a small but efficient dose of opium, in order to prevent gastro-intestinal intolerance. As a rule, this advice is very reprehensible and liable to be followed by bad consequences. The mercurial treatment must of necessity be long continued, and it is highly improper to combine it with opium, since addiction to that drug is very liable to be produced. Moreover, no system is in a normal state in which opium is given for a considerable length of time. It is well, therefore, if the necessity is urgent, to let the patient have a little paregoric or other mild opium preparation—just enough to ease the pain—which he may take, under great restrictions, as the occasion may require. Commonly only a few doses will be necessary, particularly if extract of hyoscyamus is combined with the mercurial. In many cases chalk mixture or a small quantity of tincture of ginger will be sufficient to help a patient over a rough spot. It must always be remembered that in the greater number of cases the urgent intestinal symptoms are of short duration, and that very soon the digestive tract will tolerate mercury without discomfort to the patient.

In some cases in which pills are taken, but chiefly in those in which

inunctions, fumigations, and hypodermic injections are vigorously given, colitis of different degrees is produced. This condition is attended with much pain and discomfort, and with a diarrhœa which may be so severe as to be bloody. Under these circumstances the specific treatment must be temporarily suspended and the bowel affection treated symptomatically.

Many patients who have taken mercury, even in comparatively small quantities, for a long or even short period, begin to complain of symptoms referable to the stomach. They say that they have flatulence and sour stomach, and that their digestion is slow and attended with eructations and discomfort. In its early days this condition may not be accompanied by bodily weakness, but its continuance is complicated by general debility, pallor of countenance, indisposition to exertion, and even a depression of the nervous system of such marked intensity that we may call it neurasthenia. This condition is also produced by combinations of mercury and iodide of potassium.

The mouth-lesions produced by the use of mercury are certainly less common than those just spoken of. As a rule, most patients bear mercury well; others are at first moderately affected by it; while in a very few cases its use in a short time produces toxic effects of greater or less severity. There is no point deserving of greater emphasis in the treatment of syphilis than that it is most essential to conciliate the mouth. Therefore the physician must examine this cavity in every instance before putting the patient upon treatment. If there are any bad teeth, they must be removed if possible, and if there are any teeth which, being misplaced, rub or press against the tongue, the cheeks, or the lips, they must be taken out or the uneven portion must be filed off. No portion of them should be allowed to produce injurious pressure or friction upon the parts which surround them. Then the condition of the gums must be observed, and any tumefaction, ulceration, or abnormal condition must be cured. The presence of irritating microbes and epithelial débris, which, with the tartar, forms a morbid layer around the teeth and upon the gums, is capable of doing much harm. It is imperative that this condition shall be removed. Hyperæmia or inflammation of the mouth, soft palate, and pharynx often presents very serious obstacles to the continuance of mercurial treatment; therefore these structures must receive careful attention, and local medication should be used for the removal of all abnormalities affecting them. Sigmund,[1] who in his day laid so much stress upon the necessity of a healthy mouth in the treatment of syphilis, also emphasized the fact that abnormal conditions of the nasal mucous membranes often acted as serious drawbacks to antisyphilitic treat-

[1] "Zur örtlichen Behandlung syphilitische Mund Nasen und Rachenaffectionen," *Wien. med. Wochenschrift*, Nos. 32 and 34, June and July, 1870.

ment. My own experience has taught me that it is absolutely essential that the naso-pharynx in syphilities should be carefully watched and kept in a normal state, in order, first, that no drawbacks to a mercurial-and-iodide-of-potassium treatment may exist there, and, second, that syphilitic processes, so prone to develop there, may be prevented. To sum up, therefore, I will say that in all cases the condition of the nose, pharynx, and mouth of syphilities must be sedulously watched, and if necessary treated during the whole period of general treatment. By following this advice, many a time will the physician be able to prosecute his treatment, whereas otherwise he would have had to stop for a time or give it up.

As a rule, salivation does not come on very abruptly; as Fournier says, "it does not burst out like a thunder-clap; it announces itself." But it must always be remembered that after the ingestion chiefly of calomel and blue pill, in the course of the inunction-treatment applied with too lavish a hand, in case of the too frequent repetition of very strong mercurial fumigations, and during an active course of hypodermic injections, particularly when the insoluble salts of mercury are employed, very sudden and severe, even alarming, salivation may occur. In these cases severe gastro-intestinal complications may be present. With the avoidance of an intemperate and careless system of medication, and with the watchful attention of the patient by his physician, these formidable accidents will rarely occur.

The most common symptom of mouth-lesion produced by mercury is a sensation of soreness of the gums, felt chiefly upon cleaning the teeth, and also in mastication, or from contact with vinegar or other acid fluids. Other patients will first experience uneasiness and pain around one or both wisdom teeth. In either of these instances of gingivitis we find the gums red, swollen, and more or less exulcerated, and perhaps at their teeth margin covered with a film of necrotic tissue or membrane which consists of microbes and degenerated epithelial cells. In some cases this condition is confined to the interdental prominences of the mucous membrane; in others the entire gums are swollen, softened, and tender. Under these circumstances the teeth often feel very uncomfortable, and even painful; they become more or less loose, and the patient feels that they are longer than usual. In very bad cases they drop out. As concomitants of this state there is a metallic taste in the mouth and the breath is more or less fœtid. Other patients will first complain of a metallic taste in the mouth, and it will be noticed then that the breath is disagreeable. Or before the supervention of these symptoms they may notice that the quantity of saliva is increased, and it may be watery or more or less viscid. Inspection of the mouth then shows a general condition of œdematous hyperæmia. The gums and the mucous membrane of

the cheeks at the root of the tongue and of the pharynx are of a deep-red or a whitish-red color. The submaxillary glands may be more or less swollen and painful, and the parotid may likewise be affected. Unless the process ceases, either spontaneously or as a result of treatment, the swelling of the parts increases, the tongue swells, the mouth can with difficulty be opened, and then not to its full extent, the teeth make deep impressions in the mucous membrane of the cheeks, and ulcerations may occur. In these severe cases the suffering of the patient is very distressing and painful, and deglutition is more or less impaired. The patient cannot chew or partake of solid food, and has to rely upon milk and nutritious liquids for sustenance. To add to his trouble, he grows weak, nervous, restless, and apprehensive, he sleeps little, and has no comfort anywhere. His pallid, anxious facies, his immobile and perhaps swollen mouth and lips, together with the constant flow of viscid saliva and the fœtid breath, present a truly pitiable spectacle. Luckily, we now-a-days very seldom see these formidable cases of salivation.

A general depression and impairment of the nutrition of the body sometimes occurs quite early after the ingestion or absorption of mercury. But those cases in which it may be said that there is an intolerance to mercury are happily very rare. In most of them it will be found that if the mercurial by the mouth be stopped, and its guarded use by inunction or hypodermic injection be substituted, the intolerance will cease, and that the drug will work satisfactorily.

As a result of greatly prolonged mercurialization, general debility and impaired nutrition of the body are very frequently produced. In very many of these cases the syphilitic diathesis is still active, new lesions appear, while old ones refuse to disappear, and coincidently the patient begins to look pallid and sickly, to be weak and apathetic and to suffer more or less from nervous depression. This condition is a frequent outcome of the continuous mercurial treatment, and is sometimes seen in persons who, fearful of the disease, have an insensate and irresistible desire continually to dose themselves with mercury. It is attended with dilatation of the stomach, gastro-enteritis of a mild and chronic type, perhaps colitis, and a general impairment of the nervous system and of the nutritional powers of the body. Under an enlightened system of antisyphilitic therapeutics in its broadest sense such conditions as these can be readily avoided.

Such is the value of iodide of potassium in the treatment of syphilis that, although we cannot call it a specific or an antidote in a general sense, it certainly may be termed an essential adjuvant or an important helpmate to mercury in the treatment of that disease. We may even go farther than this, and claim specificity in some cases in which, owing to the nature of the lesion, mercury takes second place and the iodide

the first. In other portions of this essay the therapeutical value of, and indications for the use of, this drug are described. We shall here consider the drawbacks and accidents which sometimes complicate its employment. Iodide of potassium is rapidly absorbed into the circulation, as can readily be shown by the starch test applied to the mouth or by touching the tongue or mucous membrane of the mouth with a solution of nitrate of silver. The starch test promptly shows the blue color of iodide of starch if iodine is present, while the pearly nitrate-of-silver stain is quickly turned into a yellowish hue, owing to the formation of iodide of silver. It is by many thought and claimed that iodide of potassium assists in the elimination of mercury from the economy. Melseus and Guillot claimed that this drug was capable of rendering soluble mercury or any of its compounds retained in the tissues of the body, and of causing their elimination with the urine. On the other hand, Suchoff[1] claims, after very minute and careful investigations, conducted under the supervision of Professor Tarnowsky, that the iodine salt really retards the elimination of mercury. Suchoff claims that the elimination of mercury by the urine begins later, and the quantity of mercury eliminated is comparatively smaller, when the patient is taking at the same time iodide of potassium.

Iodide of potassium administered during or after a mercurial course lessens at once the quantity of mercury eliminated daily. The practical conclusion to be drawn from these observations is that the iodide is not useful in mercurial poisoning, but, on the contrary, may be harmful. My own experience in the treatment of mercurial stomatitis has convinced me that no benefit whatever results from the administration of iodide of potassium.

Clinically, however, it is very frequently found that the long-continued use of mercury having failed to give relief or having produced a cachectic condition, the substitution of iodide of potassium is followed by involution of the symptoms and improvement of the health. This fact, however, does not warrant the conclusion that the auspicious result was due to any effect produced by the iodide upon mercury supposed to be stored up in the system.

The advocates of the expectant treatment and the antimercurialists (if any now exist) are impressed with the value and virtues of iodide of potassium in early secondary syphilis, and also later in the course of the disease. That this remedy is useful for some of the lesions of the early secondary stage has been pointed out in other portions of this essay, but it certainly does not follow that it is appropriate as a systematic remedy to take the place of mercury. Indeed, much harm, in the long run, is done by the indiscriminate use of the iodide, particu-

[1] "Effect of Iodide of Potassium in Combination with Mercury in Temporary and After-treatment by Mercury," *Vratch*, 1886, vii. p. 840, *et seq.*

larly in the exanthematic stage of syphilis. In this stage of syphilis there is a tendency to hyperæmia as well as hyperplasia, and very often the iodide renders worse, and even obscures, syphilitic lesions of the mucous membrane of the mouth, throat, and also lesions of the skin. Again, as we shall shortly see, the iodide itself produces multiform lesions of the skin and mucous membranes which are often very difficult to distinguish from syphilitic lesions. I have many times seen syphilitic infiltrations have their starting-points in inflammatory foci in the skin and mucous membranes which were caused by the iodide. Further than this, the iodide is inert against most of the early lesions of syphilis, and is powerless to cure the general condition. Therefore this remedy should be looked upon, as a rule, as harmful in early syphilis, and should not be employed, but it should be used in the cases and with the limitations which I have specified elsewhere.

Iodide of potassium is rapidly absorbed when taken by the mouth, which is the most common mode of its administration. It is also absorbed, well diluted in water, when injected into the rectum, but its use in this manner very often has to be suspended by reason of local intolerance. The researches of Welander have shown that this salt, administered by the mouth to a syphilitic mother, may be found in the urine of the newly-born offspring. Considering the vast number of people, old and young, who for longer or shorter periods take iodide of potassium, it certainly must be confessed that, as a general rule, the remedy is well borne by the human system. There are, however, many persons with whom the drug disagrees more or less actively. These persons are said to have the iodide-of-potassium idiosyncrasy; that is, that in one way or another the drug produces unpleasant and even toxic effects in them, which we group under the general term iodism. We also read of iodide-of-potassium intolerance, but the truth is that the cases are very exceptional in which the drug is so badly borne that its use is to be totally suspended. While there are many persons who have a greater or less idiosyncrasy against the iodide, there are few who are wholly intolerant of its use. Several years ago it was claimed by H. C. Wood[1] that in all cases of doubtful diagnosis of cerebral syphilis the so-called therapeutic test should be employed, and if 60 grains of iodide of potassium a day fail to produce iodism, for all practical purposes the person may be considered to be a syphilitic. This far-fetched assumption was very properly questioned and combated by J. William White,[2] who, in a circular letter to many syphilographers and physicians, solicited their opinion on the

[1] "Iodide of Potassium in Syphilis: a discussion by J. William White and H. C. Wood," *Therapeutic Gazette*, Dec., 1888.

[2] "Contribution to the Discussion of the Diagnostic Value of the Tolerance of the Iodides in Syphilis," *Therapeutic Gazette*, March 15, 1889.

subject. Twelve replies were sent, in all of which it was claimed that personal idiosyncrasy to the iodides was as great in non-syphilities as in syphilities; that there are no satisfactory grounds for the assertion that syphilis in any of its stages prevents the production of iodism; and that it is most unsafe to base any diagnostic conclusions upon the presence or absence of toxic symptoms (iodism) after the administration of full doses of the iodides. As stated in my reply to Dr. White, so I may state here, that I think Dr. Wood's therapeutic test a fallacy.

There are many peculiar facts connected with the iodide idiosyncrasy. In some cases a very small dose (a fractional part of a grain) will produce very severe and even alarming effects, and we may be unable even by means of many and varied expedients to overcome the intolerance. In other cases a very small dose will produce unpleasant and even severe effects, whereas a large one will be well borne, either at first or after several trials. In some cases I think that we, to use an apt expression, weaken too quickly, and give up the drug after a little rebuff, whereas with proper moral courage (the urgent necessity existing) we can increase the dose and, by persisting, establish toleration. I have seen cases in which an intolerance of the iodide of potassium lasted twenty years, and at both ends of that period produced a characteristic bullous eruption. On the other hand, I have seen many cases like that of a man who had gummatous infiltration into the soft palate, and was intolerant of iodide of potassium, but in whom I pushed the iodide until iodism ceased and the new growth was absorbed. Four years later (after a life of great indulgence) he had syphilitic pachymeningitis, took heroic doses of the iodide, showed no intolerance, and got well. In many cases abstinence from liquors, alcoholic and fermented, care as to the simplicity and easy digestibility of food, requisite medication for the stomach, and a general improvement of the condition of the alimentary canal, will be followed by a proper acceptance of the drug, after perhaps some preliminary skirmishing. I have seen several cases in which the iodides were well borne previous to the onset of pathological changes in the kidneys, and after the establishment of the latter they were more or less toxic in their action—sometimes so much so that their administration was of necessity suspended. There is very much evidence, scattered through medical literature, which goes to show that pathological conditions in the kidneys are a very frequent cause of the iodide idiosyncrasy. I can call to mind cases in which, while the patients were high livers and deep drinkers (one exclusively of champagne), the iodides had more or less toxic action, but when they discarded these irritants and stimulants the iodides produced no disturbance. In syphilities, as in non-syphilitic subjects, an intolerance of to-day may be replaced by a condition of assimilation a month, a year, or more later. This

fact should be remembered in practice, for there is a tolerably widespread opinion that the iodic idiosyncrasy is a lifelong condition.

In many cases symptoms of iodism appear early in the use of the drug; in others this complication is more or less delayed. Its supervention should not, however, lead to too early an abandonment of the drug. It is claimed by some that the presence of free ammonia (the carbonate or aromatic spirit) in a solution of iodide of potassium will prevent iodism, and by others that an alkaline salt, like the bicarbonate or acetate of potassium in combination, will also have this salutary effect; but it is not well to rely too implicitly upon these statements.

Slight or severe nausea and griping pains in the bowels may follow the ingestion of iodide of potassium. They can hardly be called toxic effects, however, for they are usually readily prevented by the addition of a little tincture of ginger or capsicum to the mixture, or of a small quantity of tannin.

The toxic effects of iodide of potassium and of the other iodides may be mild or severe; they may be simple in character, or, again, they may present a marvellous multiformity. Only a general outline of these symptoms and lesions can be given here.

The most common early symptom of iodism is a metallic taste in the mouth and throat, with sometimes fœtor of the breath. Coryza, mild and severe, is also frequently complained of, and is often regarded by patients as cold in the head. There may be mild conjunctivitis and lachrymation combined with the coryza, which may be accompanied with much sneezing and irritation of the nose and eyes, and very often severe pain in the frontal sinuses. In some cases what is called iodide grip is observed. In these rather rare instances the upper air-passages, the eyes, and lachrymal ducts are very much swollen and red. The face becomes swollen, and a red blush resembling erysipelas may be present. The pharynx becomes red and swollen, and the œdema may extend to the epiglottis and glottis. The patient suffers much from burning sensations and from pain, from dyspnœa, hoarseness, and dysphagia. Together with this formidable condition there are fever, weakness, pain in the head, and extreme restlessness. Fenwick[1] reports a case of this form of iodism in which, after four ten-grain doses of the iodide of potassium, there was such œdema of the glottis and difficulty of breathing that the patient's life was only saved by tracheotomy.

In other cases salivation occurs, which, however, is not usually as severe as that due to mercury. In most cases it is of a mild and ephemeral character.

Neuralgic pains in the head or jaws are very frequently complained of, and some patients suffer from more or less severe toothache while

[1] "Severe Case of Iodism: Tracheotomy," *Lancet*, Nov. 13, 1875.

taking this drug. In other cases there is swelling of the parotid, submaxillary, and sublingual glands, which gives rise to very uncomfortable symptoms in the neck.

It is not uncommon to see œdematous hyperplasia of the soft palate, of the tissues around the root of the tongue, of the tongue itself, and of the pharynx, in cases of acute or chronic iodism. I have under observation at the present time a gentleman suffering from secondary syphilis who, as a result of the improper and intemperate use of iodide of potassium, has swelling of the pharynx and root of the tongue, with much turgescence and prominence of the circumvallate papillæ, who was told by a prominent surgeon that he had cancer of the tongue and that his only hope was in a free extirpation of that organ. This inflammatory condition of the throat and mouth from the use of iodide of potassium, particularly when given in large doses and for long periods, is not at all uncommon, is little understood, I find, by the profession at large, and is a source of trouble and annoyance both to patient and physician.

The toxic effects of the iodides, chiefly of potassium, upon the skin are very numerous and multiform in character.[1] They may all be classed under the general head of dermatitis, of which we find a papular and papulo-pustular form (urticarial), tubercular, tuberous, nodular, bullous, and ulcerative. Besides these essential inflammatory dermal lesions the iodides may produce purpura, probably from their defibrinizing effects upon the blood. In some cases iodide of potassium produces such rapid and feeble action of the heart that its use must be given up.

Though last to be mentioned, particular attention should be called to the gastro-intestinal effects and intolerance of the iodides, chiefly of the iodide of potassium. In most cases the stomach receives the drug kindly; in others it produces a feeling of discomfort and impairs digestion. This condition may soon pass off, either spontaneously or as the result of proper medication and alimentation. In other instances it is a very serious drawback, necessitating the suspension or even the abandonment of the drug. It is always well (the necessity existing) to use every possible means to overcome this troublesome complication. After the long use of full doses of the drug patients very often complain of distressing dyspeptic symptoms and of weakness, and show evidence of emaciation. Their heart-action may be weak and their nervous system profoundly affected. Indeed, a condition of cachexia, or even of neurasthenia, may thus be induced. In such cases we must stop the use of the drug at once, put the patients upon a careful regimen, see that their hygiene is made satisfactory, build them up with tonics, and bring to their aid all fortifying influences.

[1] See my *Clinical Atlas of Venereal and Skin Diseases*, Philada., 1889, for further particulars.

It is said that long-continued use of the iodides may produce structural lesions of the kidneys.

Persons are frequently met with who have taken iodide of potassium for many years, and who are still obliged to continue it if they would keep their symptoms in check. They generally become familiar with its use, and take it in large quantities, without the physician's advice, as regularly as they take their meals. Other patients cannot, or believe they cannot, tolerate it even in the smallest doses. These are difficult cases to deal with in emergencies. Sometimes the evil is imaginary, and the idea may be dispelled by a little adroitness upon the part of the physician.

As an internal remedy *Iodol* was first used by Pick[1] in a few cases of tertiary syphilis. This observer claims that he observed sufficiently favorable results from its use to warrant its continuance as a therapeutic agent. He observed that very little toxic effect was produced by the drug, and that it had a moderately energetic therapeutic effect. Cervatesco[2] also claims benefit in gummatous effections of the pharynx, hard palate, larynx, and liver in doses of two or three grains three times a day.

Szadek[3] has used iodol in seventeen cases of tertiary and five of secondary syphilis. This author used the drug in doses of from 8 to 16 grains three times a day, continuously for two or three months. He thinks that its value consists in its harmlessness, tastelessness, and absence of odor, and in the large proportion of iodine which it contains. He found no disturbance of the gastro-intestinal canal from its use, and claims that the therapeutic results were most satisfactory, except in two cases of chronic syphilitic hemiplegia. Szadek thinks that its action is like that of other preparations of iodine, but that it is less energetic than iodide of potassium. He believes that iodol can be used instead of iodide of potassium when a mild and prolonged action is desired, but that when a rapid and energetic action is necessary it is well to employ the latter drug.

I have given iodol a careful trial in public practice in a goodly number of cases of tertiary syphilis, in which the iodide usually acts promptly and satisfactorily, and have become convinced that it has very little, if indeed any, noteworthy therapeutic effect. In this experience I find that I am in accord with Schwimmer.[4] Though I have

[1] "Ueber die Therapeutische Verwendung des Iodols," *Vierteljahr. für Derm. und Syphilis*, 1886, p. 583, *et seq.*

[2] "Ueber die Therapeutische Verwendung des Iodols bei inneren Krankheiten," *Berl. klin. Wochenschrift*, 1889, pp. 26–29.

[3] "Die Therapeutische Verwendbarkeit des Iodols in der Syphilidolgischen Praxis," *Wiener med. Presse*, Nos. 8, 9, and 10, 1890.

[4] *Die Grundlinien der Heutigen Syphilis-therapie*, Hamburg, 1888.

not observed toxic catarrhal symptoms, I have seen disturbance of the stomach and diarrhœa produced by doses of 5 and 10 grains.

For some cases of late secondary and early tertiary lesions of the skin, particularly when attended with scaling, Donovan's solution—liquor arsenii et hydrargyri iodidi—is sometimes beneficial. The dose is 5 to 10 drops, given in a bitter tincture and well diluted with water, an hour after eating.

Decoctions and infusions of such vegetables as sarsaparilla, yellow dock, saponaria, stillingia, and others have long been held in high esteem by the laity for the treatment of syphilis. They have absolutely no antisyphilitic influence, and if they are beneficial at all, the effect is due to their influence as tonics, stomachics, diuretics, or diaphoretics. They may be beneficial as adjuvants to mercury and iodide of potassium.

In Germany largely, and in America not very frequently, Zittman's decoction is used in old, obstinate cases of syphilis when the usual remedies are badly if at all borne, and when the physician is at his wits' end to know what to do. In many very unpromising cases I have seen beneficial, and even striking, results; hence this remedy should be kept in mind. The formulæ for the strong and the weak decoctions are as follows:

Zittman's Decoction—Strong.

℞. Sarsaparilla, cut, ℥xiiss;
Water, ℥325, troy.
Digest for twenty-four hours, and add—
Alum,
Sugar, āā. ʒvj,
enclosed in a linen rag. Heat by a steam-bath, in a covered vessel, for three hours, adding toward the close,
Anise,
Fennel, āā. ʒiv;
Senna, ℥iij;
Licorice-root, ℥iss.
Express, strain, and after several hours decant. It should weigh 312 troy ounces. Put aside as a strong decoction.

Zittman's Decoction—Weak.

Add to the dregs of the strong decoction,
Sarsaparilla, bruised, ʒL;
Water, ℥325, troy.
Heat by a steam-bath, in a covered vessel, for three hours, adding toward the close,
Lemon-peel,
Cinnamon,
Cardamom,
Licorice-root, āā. ʒiij.
Express, strain, and decant; it should weigh 312 troy ounces.
Label "Weak Decoction."

When decoction Zitmani (with one *t*) is prescribed, it is prepared in a similar manner, except that to the sugar and alum are added, enclosed in a linen bag—

℞. Calomel, ʒj;
Cinnabar, gr. xv.—M.

Of the strong decoction it is necessary to drink a pint in the morning, and of the weak a quart in the evening. The effect of this treat-

ment is enhanced by placing the patient in bed and inducing well-marked diaphoresis. These large doses produce also a cathartic action, sometimes very violent, and it may be necessary to reduce them. I have seen much improvement in the patient's general condition produced by this method. It frequently improves the appetite, and by its cathartic and tonic effect renders the system tolerant of active antisyphilities, which previously had acted badly.

Under the name "succus alterans" a remedy has attained much vogue within a few years in the treatment of syphilis, chiefly among the laity. It is made of roots and herbs. This preparation was first exploited by the late Dr. J. Marion Sims, who claimed that it had produced wonderful results in the treatment of syphilis in Southern negroes. The following is a modification of the prescription of Dr. McDade, in whose practice Dr. Sims first saw it used:

℞. Ext. smilacis sarsaparillæ, fl.,
Ext. stillingia sylvat., fl.,
Ext. kappæ minoris, fl.,
Ext. phytolaccæ decand., *āā.* f℥ij;
Tinct. xanthoxylon carolin., f℥j.—M.

Take a tea-spoonful in water three times a day before meals, and gradually increase to table-spoonful doses.

I have seen many patients who have taken this remedy at the advice of physicians and of their own accord, and have never seen it produce the slightest antisyphilitic effect. In some cases it seemed to exert a mild tonic action, and in others produced a pleasing purgative effect. It is a remedy in high esteem among some syphilitic cranks, who, though cured, will persist in swallowing drugs. I have known it to be prescribed as a placebo in the intermissions of a mercurial course. Doing no harm, it can do little good, and the human race will not be the loser when this compound shall have had its day.

As an adjuvant in the treatment of syphilis the fluid extract of coca is a very valuable agent. It is in no sense a specific, and its beneficial action consists in its marked tonic effect upon the heart, capillaries, and nervous system, and upon nutrition in general. In anæmia and cachexia and in the adynamic condition occasionally induced by mercury and iodide of potassium it sometimes works wonders. In some cases I have seen it induce a condition of health by which mercury, which at first was badly borne, become tolerated and curative. In malignant precocious syphilis it acts well by improving the general nutrition. It is very often beneficial to patients addicted to alcoholics, and it may then take the place of those stimulants. My favorite prescriptions are as follows:

℞. Fl. ext. erythroxylon cocæ, f℥ij ;
Tinct. cinchon. comp.,
Tinct. gentian. comp., āā. f℥ij.—M.
Sig. Two tea-spoonfuls in a wine-glass of water three times a day, an hour after meals.

℞. Fl. ext. erythroxylon cocæ, f℥ij ;
Tinct. gentian. comp.,
Tinct. cinchon. comp., āā. f℥j ;
Elix. calisayæ, f℥iv.—M.
Sig. One table-spoonful in a wine-glassful of water three times a day, one hour after meals.

The *thé Mariani* is a very reliable preparation of coca, being practically a fluid extract. In some cases this preparation produces sour stomach, which may be obviated by temporarily reducing the dose. In others, again, a sensation of fulness in the head, burning of the eyes, and buzzing in the ears—in fact, a sensation of mild intoxication—may be produced. Under these circumstances the dose should be reduced.

The use of bichromate of potassium in syphilis is only to be mentioned and condemned.

The Inunction Method.

The inunction treatment, which consists in rubbing into the skin metallic mercury or some mercurial preparation, mixed or suspended in a fatty vehicle, is the oldest method known,[1] and is the one concerning which the testimony of all physicians is that it is the most active, sure, and rapid in its effects of any mode of administering mercury. The objections to it are that it is dirty, unpleasant, and disagreeable; that it soils the skin and the patient's linen and the bedclothes; that it necessitates time and trouble in its use, and subjects the patient to the risk of exposure. For these reasons it is repugnant to many patients, particularly to women. Some claim that the method is unscientific and not exact, which may be true, but it is efficacious. Many authors lay particular stress upon the occurrence of stomatitis from the employment of this method, and give their readers the impression that this danger is inevitable. Such statements are either

[1] Mercurial inunction was used at the very earliest period of the authentic history of syphilis. In Douglas's *Bibliographica Anatomica*, Lyons, 1734, it is said that Berengarius was the discoverer of its merits, as shown by the following: "Jacobus Berengarius Carpensis ita dictus a Carpi civitate in Italia . . . . inunctions ex hydrargyro in curâ luis venereæ primus fuit inventor illoque solo quæstu mirè oppulentus redditus est." Also in Joseph Grünpeck's *Tractatus de Pestilentiali Scorra sive mala de Franzos*, 1496, mercurial ointment for the cure of syphilis is mentioned, as well as a gargle to be used in case of salivation.

based upon the want of a thorough knowledge of this method of treatment and of its technique, or upon results which have followed its careless and intemperate use.

Inunction treatment of syphilis by mercury has, particularly within the past ten years, come into more general use and favor, and the present indications are that it will be more and more widely adopted than heretofore, not only as an adjuvant, but also as the regular system of cure. A very noteworthy fact to be gleaned from the words and writings of the most advanced syphilographers is, that they are gradually losing faith in mercury by mouth-ingestion as the regulation method of treatment, and are using mercurial inunctions much more frequently and for much longer periods than they did in former years. The fear which was once so general as to the use of mercurial frictions has very largely passed away, and confidence in this method is gradually extending. This is largely due to the fact that our knowledge of syphilis is more precise and extended than in former days, and that we are better able to determine the conditions produced by the disease, and also the morbid states actually caused by the improper use of mercury. The indications to-day are, that this mode of treatment will ultimately supplant in a general way the other modes, though mouth-ingestion will of necessity be used in very many cases under certain conditions as a method of expediency, and fumigation will still be employed, and injections given according to the varying condition and peculiar necessities of the cases.

It is a mistaken idea that most patients will not undergo the inunction cure. There are those who, by reasons of indifference and of the drawbacks incident to the method, and for prudential considerations, may be unwilling or unable to submit to it. But, on the other hand, I have found, and others have found and will find, that if the advantages of the treatment are clearly and conspicuously presented to the patient, he—or even she—will usually adopt it. It is also a mistake to think that intelligent, well-to-do patients will, as a rule, refuse this method of treatment. They of course would prefer the simple and expeditious method of mouth-ingestion, but when they are told of the great and paramount advantages of the inunction method, of the immunity from present discomfort and suffering which it offers, and the future cure which it renders so probable, they very generally consent to undergo it. Indeed, in my experience it is much easier to obtain the consent of patients in the upper walks of life to submit to and follow up the inunction cure than it is to deal with patients in a lower sphere of life. Intelligent people, having syphilis, as a rule realize the jeopardy that they are in, and are willing to submit to much discomfort and annoyance, provided they have a reasonable hope that they are to be the gainers thereby. On the other

hand, it is almost a hopeless task for the physician to treat patients who are not intelligent and whose sanitary surroundings are not good. In dispensary practice it is often hard work to make patients use their inunctions, and in hospitals the mercurial friction should be administered by the orderly or nurses, for as a rule the patient will make away with his packet of mercurial ointment, and little if any of it will reach his skin.

Though many authors have written in favor of the inunction treatment, it must be conceded that the writings of Sigmund[1] have done most to popularize the method, to rid it of its dangers, and to place its employment upon a safe and scientific basis. In earlier days the method was followed in a crude and even reckless manner, and as much harm as good resulted from its use. A quotation from Brandis[2] will be of interest in this connection. He says: "Formerly, indeed, the dread of inunction was well grounded: let us consider how patients were treated who were obliged to undergo this course. For weeks at a time they remained shut up in hot chambers filled with mercurial vapor. The ingress of fresh air was carefully avoided, and merely starvation diet was allowed. Nevertheless, surprising cures often took place, which caused so much the more astonishment as the most desperately obstinate and severe cases were selected. But what results were not produced! Salivation, mercurial fever, wasting of the tissues, even death itself, not infrequently followed." Sigmund's dictum was as follows: "In the treatment of syphilis we not only do not require the manifestation of mercurial poisoning, but we cure venereal disorders more surely in proportion as we guard the body from such manifestations."

In adopting the inunction method many considerations should be borne in mind. In the first place, it is absolutely essential that the hygienic surroundings of the patient should be in a satisfactory condition. He should have plenty of fresh air and good, generous food, and should be comfortably situated at his home. He should be as free as possible from mental and physical strain, and should have ample time for exercise, rest, recreation, and sleep. While undergoing this course of treatment he should use every effort to keep his health and nutrition at as high a standard as possible, and to keep himself from hurry, bustle, anxiety, care, worry, and mental over-strain. He should eat such food as will nourish best, and avoid all that taxes his digestive powers. He should be careful to avoid all beverages which tend to derange the stomach or cause diarrhœa. Exposure to cold and dampness must be carefully guarded against, and, though an abundance of fresh air is necessary, ample protective clothing must be worn. In

[1] *Die Einreibungscur mit grauer Quecksilbersalbe bei Syphilisformen*, Vienna, 1878.

[2] *Principles of the Treatment of Syphilis*, Dublin, 1882.

winter flannel should be worn next to the skin, and his bed-room should be well ventilated and kept at a temperature of about 65° Fahr. Moderate exercise is to be commended, but violent, excessive, or exacting physical exertion (the so-called athletic sports) is to be condemned. As a general rule, if the condition of the case is not urgent and will admit of it, it is well during periods of severe cold and great dampness to omit the inunctions if the patient is obliged to be out of doors, and also during periods of intense heat in the city. There is a prevailing opinion among the profession and the laity that persons undergoing an inunction-cure are to an unusual degree liable to take cold. It is well always to see that these patients are not unduly exposed and that they are properly protected, but as I look back I can recall many patients of the out-door dispensary class who, despite warning, exposed themselves to cold while using the inunctions. On this subject Raphael,[1] who had a large out-door-poor service for many years at Bellevue Hospital, says: "As regards the danger to patients of taking cold during its employment, all I can say is that I have repeatedly seen patients come to my out-patient clinic with a considerable amount of the mercury rubbed in upon their person, without the least harm resulting therefrom (though they were cautioned against such a course), evidently having gone about in that condition for days without washing off the ointment, many of these patients being insufficiently clothed at that." My experience in the same syphilitic service many years ago was precisely like that of Dr. Raphael. Brandis very pertinently says on this subject: "Excessive dread of catching cold, even at the present day so widely disseminated, causes frequently great harm. Of course every intelligent patient will protect himself from cold; but we frequently meet with people who make themselves ill by carrying their precautions too far."

The most reliable and efficient preparation of mercury for the inunction cure is the officinal mercurial or blue ointment—unguentum hydrargyri—of a strength of 50 per cent., as a rule. In some cases the mild ointment (25 or 30 per cent.) may be used. It is most important that this preparation shall be well made and perfectly fresh. It is not sufficient simply to order the blue ointment, but the patient should be impressed with the necessity of obtaining a perfectly pure preparation, and should be particularly instructed to purchase it of only reliable apothecaries who frequently renew their stock. Many instances of irritation of the skin are due solely to the rancidity of the ointment rubbed in. The matter of the dose should be carefully looked after, so that absolute precision is obtained. Some

[1] "On some Practical Points in the Treatment of Syphilis with Inunction of Mercury," *N. Y. Med. Journal*, March 6, 1886.

authors—and among them Cheminade[1]—think that lanoline is to be preferred to lard in the manufacture of mercurial ointment—an opinion with which I must emphatically differ. I had some mercurial ointment thus prepared, and it was pronounced by patients who were by no means faultfinding to be very unsatisfactory, in being less readily rubbed in and being sticky, gummy, and much less effective and absorbable than the officinal ointment.

The oleates of mercury have not realized the hopes that were formerly entertained as to their ultimately taking the place of blue ointment in the treatment of syphilis. In the form of 20 and 30 per cent. preparations the oleate of mercury is very irritating to the skin, even more so than blue ointment. My colleague, Dr. Bumstead, used with preference equal parts of 20 per cent. oleate of mercury and simple cerate, which is an unirritating preparation. Of late years I have used a combination of the oleate of similar strength and proportion with vaseline. Schwimmer[2] uses 15 grains of oleate of mercury (20 per cent.), mixed with 30 grains of vaseline—a quantity which he orders for one rubbing. The oleate of mercury, however combined, is rather more apt to irritate the skin than blue ointment, and must be used with much caution and with not too much friction. It is at best a less reliable and efficient preparation than blue ointment, and should be reserved for over-fastidious patients. As a remedy for general medication in syphilis it has little to commend it, and as an agent for local or regional treatment it is far inferior to white precipitate ointment or ointments made of several other mercurial preparations, notably the protoiodide, the deutoiodide, the tannate, salicylate, and the bichloride.

In general, the quantity of mercurial ointment advised by writers is too large. It is essential for the successful treatment of syphilis to avoid the two extremes of very large and very small doses. No arbitrary rules can be laid down, but general principles may be stated, and by them a physician must judge how much of this remedy he shall prescribe. It is important to remember that in general city practice (the patients being usually of the active, busy order) a rather smaller quantity should be used than we should employ upon one who has the opportunity of recreation away from home and its cares. Fournier[3] says that Doyon has been able to use 5 drachms of mercurial ointment at the Uriage Thermal Springs in combination with the waters.

[1] "De l'Emploi de la Lanoline comme Vehicule de l'Onguent napolitain dans le Traitement de la Syphilis," *Gazette hebdom. des Scienees méd. de Bordeaux*, 1887, viii. p. 433, *et seq.*

[2] *Die Grundlinien der Heutigen Syphilis-therapie*, Hamburg, 1888, p. 51.

[3] "De l'Emploi des Frictions mercurielles dans le Traitement de la Syphilis." *Union médicale*, June 11, 1891.

and at other thermal springs larger quantities of the ointment can be used than at home. I have been able, the necessity existing, to use at our seaside resorts, the patients taking daily hot salt-water baths, quantities of mercurial ointment which at home would be harmful. So that we must remember that there is an average, fairly large dose for a patient who is at a watering-place or a rural abode of recreation, and another and smaller dose for those who have to stay at home, and who cannot throw off their social or business cares, but are confined to the daily treadmill of city life.

In general, for adult recreating patients following hygienic rules 60 grains of mercurial ointment may be employed for each friction. This, as a rule, will be well borne by a man of good physique and average build, but it would be too large for a thin, spare man of weakly constitution. At thermal springs as much as 120 grains are sometimes used in their "lightning cures," but such quantities are scarcely called for, and should only be used with the greatest care and circumspection.

For general practice the average dose of blue ointment may be stated at from 20 to 45 grains, a larger dose being used upon robust and well-developed patients, and a smaller one upon those of thin and flabby structure. The early rubbings are largely tentative, with a view of gauging the patient and the dose. The inunction-treatment should never be begun in a careless manner. The case being a suitable one, two or three frictions of 30 grains each may be tried and the effect watched. Some patients bear these inunctions when of generous quantity with remarkable tolerance for very long periods; others, again, show evidence contraindicating their use after from three to six rubbings. Therefore, the physician should have his patient well in hand, and watch him very carefully every day or two until he has been under the treatment for at least two or three weeks. As the frictions are given and benefit is evident, the dose may be increased to 40 or 45 grains of the ointment; and in general, for regular routine treatment, this quantity will be found ample, but in emergencies and exigencies a larger quantity will be required. While the patient is under this treatment (the general and special condition being favorable) the physician must watch and question him, to learn that he feels stronger and even gains weight, which is very common when this treatment is beneficial, and is really one of the first signs of improvement, or that he loses flesh; that his strength is satisfactory; that his appetite is good and digestion perfect; that he has no elevations or oscillations of temperature; that he sleeps well at night and awakes refreshed; and that he is in no manner troubled with any nervous symptoms, even slight. If, in short, a man shows evidence of doing well, has no mouth, stomach, or intestinal troubles, and it is evident

that his lesions and symptoms are being bettered, the physician may know that he is on the right track, and should go ahead, but should always be on the lookout for the mouth and the gastro-intestinal tract. When mercury is thus introduced through the skin, it is thought that it enters not by the lungs, but by way of the sweat, hair, and sebaceous follicles into the lymph-spaces, and then it becomes albuminized and ready for absorption. We then have the stomach free for food, tonics, or the iodide of potassium if it is indicated. Thus we may improve digestion and nutrition by agents, such as iron, quinine, strychnine, coca, hypophosphites, etc. This coincident tonic course is often very beneficial in improving the condition of the syphilitically affected tissues, and in rendering them more amenable to the specific action of the mercury. In this connection it is to be prominently remembered that a decided tonic action is produced by generous, nutritious diet, which does so much to engraft upon the tissues the power of resistance to the syphilitic poison. This fact has recently been well brought out by Dymnicki,[1] who strongly advises quinine in weak and debilitated syphilitic persons whose temperature and weight are subject to great oscillations. By its use the bodily weight is increased and general improvement follows. Dymnicki found—and my experience is in accord with his—that in many cases the use of quinine enables us to increase the quantity of mercurial ointment. Schwimmer[2] advises in weakly and anæmic persons a preliminary course of the syrup of iodide of iron before beginning the inunction treatment. In my own practice I have often derived benefit from a similar course.

The next consideration is the preparation of the skin for the inunction treatment. The circumstances and conditions are rather different when the treatment is received at home from that administered at thermal baths and at health resorts. When the patient undergoes the frictions at home he must first have a local or general bath. As a rule in city life, the inunctions are of necessity taken in the evening, whereas in health resorts it is well that they should be taken in the morning. The home patient may take a bath at a temperature of 96° to 98° F., after which he should be well rubbed with a towel. When possible, in warm weather one or two Turkish baths a week may be taken in alternation with the regular baths. But of these baths the physician must be very watchful, and if they in any way tend to debilitate the patient, who under the circumstances sleeps poorly and awakes unrefreshed, stiff, and weak, they should be discontinued. Under these circumstances, and when it is impossible to have bathing facilities, the part to be

[1] "Action of Quinine in some Grave Cases of Syphilis treated by Inunction, affecting Temperature, Pulse, and Weight of Body," *Gaz. Lek. Warszawa*, 1889, 2, 8, ix. p. 388, *et seq.*

[2] *Loc. cit.*, p. 79.

anointed should be carefully washed with warm water and soap, and then sponged with a 2 or 3 per cent. solution of carbolic acid. This latter application should also always be used after the general bath. By strict attention to the aseptic condition of the skin we can almost always avoid dermal inflammatory complications. When it is urgently necessary to treat parts covered with hair, they may be clipped, or even shaved, and then thoroughly washed with the carbolic solution. Upon parts sparsely supplied with hairs great care should be taken that an aseptic condition be produced. By means of this care many unpleasant drawbacks may be avoided.

It is always best that the inunctions should be made by a professional rubber or a trained nurse, if possible. If, owing to circumstances, the patient must be his own rubber, he should be made clearly to understand the technique. In the first place, the physician must see that the dose is made precise, and if the ointment is put up in packets of oiled paper allowance must be made for the loss occasioned by the adherence of some of the ointment. Then no glove or pads or protective coverings to the hands should be used. It is a mistaken idea that persons administering the inunctions are liable to salivation, for they are not, provided they take ordinary precautions. I have employed many trained rubbers and nurses in this treatment, and I have never seen any untoward condition of the hands result. Brandis, Wilson,[1] and others, who have had much experience at Aix-la-Chapelle and at our own Hot Springs of Arkansas, also speak of the immunity to local and general mercurialization enjoyed by professional rubbers. The simple procedure of anointing the hands with oil or with a stiff simple cerate, or even with soap, will effectually prevent the absorption of the mercurial ointment.

The ointment should be divided into several portions, and each one should be firmly rubbed into the skin, employing the two palms when the anatomical arrangement of the parts will admit of it. Combined with the friction, a moderate amount of massage may be practised. In this way all the ointment must be rubbed in, so that no lumps are left, and the surface of the skin will then look as if it had been lightly pot-leaded. As a general rule, from twenty to thirty minutes are necessary for an inunction. After this operation suitable night-clothes should be put on to protect the bed-linen, and the patient should retire. When the preliminary general bath cannot be taken, it is well to let the patient drink directly after the rubbing a pint or more of pure hot milk, and then cover himself up well with blankets in order to induce perspiration. According to his case and to the whim of the patient, hot lemonade or hot tea (and in some cases a little brandy, whiskey, or gin may be added) may be taken to produce diaphoresis after the inunction.

[1] "On the Treatment of Syphilis," *Lancet*, March 27 and April 5, 1886.

For this purpose hypodermic injections of pilocarpine have been used, but, according to my observation, they are not beneficial in any way. Lewin and Zeissl also found pilocarpine inefficient, and even harmful, in the treatment of syphilis.

At thermal springs the patient has his hot bath early in the morning, then his inunction, followed by a period of repose and sweating. After that he is ready for his walk, and during the day may partake of the mineral waters of the place. In my judgment (as I state elsewhere), no specific effect is produced by the waters, either taken internally or used for baths, at the Hot Springs of Arkansas, at Aix-la-Chapelle, or at any other thermal resort. The beneficial effect is largely derived from a variety of conditions, such as climate, rest, recreation, and abstinence. It is very certain that at all springs and health resorts the inunction treatment, vigorously pushed, is well supported. This applies to patients who pursue the method at our seaside resorts and use hot salt-water baths, and also those at thermal and mineral springs. The same tolerance of mercury may be obtained in the mountains and in rural districts if patients are subjected to rigid rules of hygiene and regimen. It is a matter of congratulation that at our own Richfield Springs all the benefits so much vaunted at Aix-la-Chapelle and Uriage may be obtained. When patients are stopping at sulphur or mineral springs they instinctively desire to drink the waters, but they should do so only under medical advice and supervision. It is claimed that sulphur waters exert a depurative action and carry off the mercury and effete products through the kidneys and intestines. This contention is not clearly settled; therefore I usually tell patients to try the sulphur waters in moderation, and if they agree with them and they are seemingly benefited, they may continue their use. But very often these waters produce dyspepsia and gastro-intestinal, and even cystic, irritation, and it is necessary to abandon them. The other mineral waters at our resorts should be employed only under proper advice.

Among many of the laity, and among some physicians, there is an impression that the use of sulphur baths and waters internally may have an influence in rendering evident a latent or dormant syphilitic condition, and some physicians at the thermal springs put their patients through what they term a test or proof cure or treatment. In my judgment, this opinion is incorrect, and I agree with Spillman,[1] Brandis, and others that the instances in which, after sulphur-water treatment, a latent syphilis is called into activity are either mere coincidences or the result is due to the same influences which ordinary vapor

[1] "Influence des Eaux sulphureuses dans le Traitement de la Syphilis," *Comptes Rendus de la Société de Médecine de Nancy*, 1882.

or hot-water baths may produce. It has been claimed by Güntz[1] and others that the waters and salts of sulphur springs may be used with benefit in combination with the inunction treatment followed at patients' homes. I have given this method a careful trial, and I have seen it followed in the practice of other physicians, and my opinion is that no perceptible good is gained, though much trouble and expense is entailed. In every large city the facilities for obtaining sulphur baths are ample, and it is advisable in those cases in which the inunctions seem to be backward in their effects to allow the patient to take a few of them as an experiment. In general, one or two sulphur baths a week during an inunction treatment may be a benefit. They certainly have a decidedly happy moral effect on some patients. In cases of ulcerative lesions particularly, and also in those of the papular and tubercular forms, sulphur baths and simple hot-water and vapor baths are often of much aid by reason of their stimulation of the skin.

The points of distribution over the body of the inunction treatment deserve careful consideration. Sigmund[2] advises the following: On the first day both legs are to be rubbed; on the second, both thighs; on the third day, both arms; on the fourth day, the abdomen and breast; and on the fifth day, the sides of the body and the gluteal regions. Dr. Bumstead[3] preferred the following order of applications:

First evening, to the buttocks.

Second evening, to the thighs, but not near the groins or scrotum.

Third evening, to the sides of the chest, but not in the armpits.

Fourth evening, to the internal surfaces of the arm and forearm.

Fifth evening, to the back or belly; the former application is best made by an assistant, whose hand is protected by a glove. (This precaution is not necessary.—R. W. T.)

Sixth evening, omit the application.

Seventh day, take a bath in the morning, change under-clothes, and in the evening resume the applications as above.

Within the past ten years I have seen the wisdom of, and the necessity for, a more extended and comprehensive application of mercurial ointment in the treatment of syphilis; and my observations, worked out upon a clinical basis, have been confirmed by certain pathological studies made by Neumann.[4] This observer has shown that several months (four to eight) after the disappearance of visible syphilitic lesions there may remain in the skin in and around its glands and follicles, and around its vessels, morbid products consisting of exudation

[1] *Die Einreibungscur bei Syphilis in Verbindung mit Schwefel-wassern*, Dresden, 1873.

[2] *Loc. cit.*, p. 37.

[3] Bumstead and Taylor, *Venereal Diseases*, 1883, p. 861.

[4] "Welches Sind die Anatomischen Veränderungen der luëtischen Haut nach Ablauf der Klinischen Erscheinungen," *Wien. med. Wochenschrift*, 1885, xxxv., p. 825, *et seq.*

cells. This infiltration of small round cells is not as copious and extensive as it is in very early syphilis, but its occurrence certainly shows how the disease may remain latent in the system. On this subject I may quote with benefit from my recent paper:[1] "There is one fact that the surgeon should always keep in mind in the treatment of syphilis—namely, that all syphilitic lesions, even the most minute, are to be feared as possible sources of continuous or intermittent reinfection of the system. The morbid cells contained in these lesions are capable of great, even infinite, multiplication, and the so-called syphilitic relapses are due to the continual recurrence of these cell-proliferations, which occur from morbid foci left over at an earlier date. While all deposits of syphilitic new-growths in any part or tissue are of much danger in their ultimate results, those which occur in the lymphatic ganglia, in the lymphatic vessels, and around blood-vessels are especially so by reason of the activity of growth of these organs, and of their very ready transposition to all parts of the body by means of the lymph- and blood-circulation."

Pathological facts like these prove to us very forcibly that besides the general mercurial action through the blood, we should, whenever it is possible, bring mercury into direct contact with the syphilitic processes by what is termed the local or regional method. For this purpose the inunction treatment is especially adapted, since by the absorption of mercury through the skin morbid processes there latent are cured without in any way impairing the general constitutional results.

It is very possible that even with a supposed well-regulated inunction course after the older plans, some lesions may escape, and thus the perpetuation of the disease be allowed. This fact is forcibly shown by a case reported by Köbner[2] in a valuable paper on the local and regional treatment of syphilis, of a man who was covered with an unusually extensive and abundant papular syphilide, who had upon the back a molluscum pendulum as large as a nut, upon which there were two papules. After six weeks of treatment, due to enormous induration of the lymphatic ganglia, in which no less than sixty drachms of mercurial ointment were used, all the papules underwent involution except the two upon the molluscous tumor, which had escaped the inunction process. This striking case is only a conspicuous example of what we constantly see when inunctions are not universally made over the whole body. Thus even with toxic symptoms of mercurialization present, syphilitic lesions about the anus and head and elsewhere, which have not been brought into direct contact with the

[1] "Some Practical Points in the Treatment of Syphilis," *Med. News*, Dec. 7, 1889.

[2] "Ueber therapeutische Verwerthung der localen antisyphilitischen Wirkung des Quecksilbers," *Tageblatt der Versamml. Deutsch. Naturf. und Aerzte;* and *Deutsche med. Wochenschrift*, 1884, p. 757, *et seq.*

mercurial ointment, will very frequently be seen to persist. Yet in these cases the patient (and I have very often found his physician to agree with him) thinks that he has been undergoing a most thorough cure, and they both marvel that in spite of such seemingly energetic measures the disease should persist.

Therefore, I say that we should carry out the inunction treatment in a far more systematic, thorough, and minute manner than has been generally done. To this end I divide the body into eleven subdivisions, each of which is to be submitted to its own mercurial friction. They are as follows:

1. The neck and head.

2 and 3. The arms, palms, and axillæ.

4 and 5. The legs and soles.

6 and 7. The thighs, with groins and Scarpa's triangle.

8 and 9. The breast and abdomen.

10 and 11. The back from the root of the neck to lower part of the gluteal region.

In non-hairy persons there is little trouble in anointing the neck. In those whose necks are densely covered with hair we may be forced to confine the inunctions to the parts not covered. In urgent cases and where the lesions are copious it is necessary to have the hair clipped or shaved. If there are scalp lesions or any in the beard an ointment composed of white precipitate 30 grains and vaseline 1 ounce may be used freely. In this case it may be well to make the regular dose of mercurial ointment used elsewhere on the neck smaller. Prior to rubbing the ointment into the scalp and beard shampoos and antiseptic lotions should be used.

It is important that the whole surface of the arms should be acted upon in a vigorous manner. If there are any lesions of the palms, these parts should receive careful attention, and in any case it is well to anoint them several times during the treatment. It is most important to bring the ointment into contact with the contents of the axillæ; and this can be done with impunity, provided care is taken that the parts are brought into an aseptic condition.

The legs and the soles should be well rubbed with both hands, and any lesions upon the latter parts should receive especial attention. In like manner the thighs should be treated, and the groins and the surface over Scarpa's triangle should be firmly rubbed for a sufficient time. If the ganglia in the groins are unusually swollen, it may be necessary to apply a layer of mercurial ointment on lint or one of the mercurial plasters. Great care must be exercised to keep the ointment from the scrotum.

Sometimes the inunctions produce irritation upon the breast and abdomen, and the method is pursued with difficulty. Under these

circumstances all means toward the avoidance of dermatitis and follicular inflammation should be adopted.

Patients rarely have any difficulty in administering to themselves inunctions upon the buttocks, but it is impossible for them to reach their backs. Therefore it is necessary to get outside aid, which in most cases I have found possible. By this method the whole body is treated in eleven séances. In many cases, when we use from 35 to 45 grains of the ointment for each rubbing, we can give the whole series of eleven on successive days. But, as I have said before, we can never be positive that we can do so; therefore the patient must be watched and questioned each day as to his condition. In this way we feel our way along, and continue or suspend the inunctions as the indications of the case teach us.

In giving a regular treatment by inunctions it is well to omit them for a few days, according to the indications, and then to go over the same ground again. In a systematic treatment we may give from fifty to eighty, or even a hundred, inunctions with proper intermissions, and then it is well to desist for a short or long time. In ordinary cases, where the inunction method is used as a regular mode of treatment, it may or may not be necessary to administer the iodide of potassium at the same time. In most cases it will not be necessary to employ a large dose of this salt. But in old and untreated cases it will be necessary to use stronger doses of the ointment, perhaps employ them more uninterruptedly, and combine them with large doses of the iodide given internally. This question of the conjoint use of inunctions and iodide of potassium will be considered farther on in the section upon Special Medication.

It sometimes happens that we desire to keep up a mild mercurial action, and the circumstances of the patient will not admit of the employment of frictions. In these cases the ointment may be spread upon a canton-flannel belt, which may be worn around the body. In cases of enlargement of the spleen, tenderness over the liver, with or without jaundice, pain in the chest (pleuritic or resembling angina pectoris), and in swollen and painful joints, these mercurial bandages may be employed with much benefit. This method is also useful in the treatment of syphilitic infants and children.

Though the inunction treatment is uniformly potent and beneficial, it has its drawbacks and complications. These are—1, dermatitis and follicular inflammation; 2, stomatitis and salivation; 3, digestive disturbances and intestinal complications; 4, sleeplessness; 5, inanition and exhaustion; 6, tendency to congestion of the head, heart, and lungs; 7, tendency to fever and perspiration; 8, pain in bones and joints. Though this list looks rather formidable, in actual practice the cases are few in which it is necessary to abandon the treat-

ment or in which modifications and expedients fail to smooth matters over.

With careful antiseptic attention to the condition of the skin, and with the employment of fresh and pure ointment, we rarely encounter such an amount of inflammation in it that the patient is made to suffer or that the treatment is curtailed. Zinc ointment, Lassar's paste, and dusting powders, with protective layers of cotton, are very beneficial in the prevention of dermal inflammation.

Under the older system of inunction, when a larger quantity of blue ointment was employed, it was not uncommon to find mouth and throat lesions. When, however, the treatment is carried out on the lines heretofore indicated, the occurrence of salivation will be rather rare. Mouth lesions from inunction are similar to those produced by the internal use of mercury, with the exception that their onset is more sudden and abrupt and their severity greater. It is therefore necessary to follow the directions already given in the matter of attention to the teeth, mouth, and throat, to prevent salivation. It is also well to make the patient rinse the mouth well with solutions of chlorate of potassium and alum, and also with a mild solution of sugar of lead and acetate of alumina in peppermint-water. This precaution is particularly necessary when for any reason we are compelled to push the treatment.

Very often a reduction of the dose or its temporary suspension will cause the disappearance of irritability of the stomach. The trouble should also be treated symptomatically. In like manner, intestinal irritation should be treated, and very often much benefit will result from a full dose of castor oil.

In some cases sleeplessness is but an ephemeral symptom. It may persist and necessitate a suspension or diminution of the treatment. The bromides, sulphonal, phenacetin, and perhaps morphine and chloral, may be temporarily resorted to, but always under the physician's knowledge and full direction. It is better to abandon the method than use any of these drugs for a long time.

In women particularly, a feeling of exhaustion and inanition, perhaps with digestive disturbance, may complicate the inunction treatment. The usual expedients of lowering the dose, of allowing intervals of repose, and of administering tonics, should be resorted to. If, after a conscientious trial of the method, these symptoms continue, it must be given up.

Tendencies to congestion of the head, heart, and lungs should be treated symptomatically, and the frictions carefully pushed and watched.

A feverish condition, with or without perspiration, or the occurrence of the last symptom alone, call for quinine and iron tonics,

generous food, and perhaps a mild malt liquor, or even claret or burgundy in moderation.

Pains in the bones and joints, fixed or fugitive, may give more or less trouble. They usually pass away by care on the part of the physician and patient. I have met with several cases, however, in women in which these symptoms were so severe that a discontinuance of the frictions was made necessary.

A mild and continuous mercurial effect may be produced by the application of plasters of mercurial ointment. This may be spread on chamois-skin, and adjusted to the body by means of a belt made of flannel or of canton flannel. In cases of lesions of the spleen or liver or of intrathoracic pains in early syphilis this method of mild mercurialization is very beneficial. It may also be employed in cases in which, for any reason, inunctions are contraindicated. In many cases of hereditary syphilis mercurial ointment may be kept continuously upon one or more regions of the body with decided benefit.

Akin to this method of using mercury is the application of mercurial plasters. The old-time emplastrum de Vigo, in which Chassaignac placed so much confidence, may be used, either in large plaques or on small surfaces for local treatment. There are in the market at present several mercurial plasters which are worthy of use.

This slow and prolonged treatment is much extolled by Unna,[1] particularly for commercial travellers and those very desirous of secresy. He uses a mercurial plaster-mull, and with his usual ingenuity has devised a frame of zinc glue which serves to keep the plaster in place and to prevent it from melting at the edges, with its inevitable discoloration of the skin and the under-wear. In severe cases of paralysis, cranial exostoses, etc. Unna girdles the entire trunk with his mercurial plaster-mull.

A modification of the foregoing treatment has recently been proposed by Quinquaud,[2] who uses a calomel plaster made as follows:

℞. Emplast. diachyli,	3000	parts;
Hydrarg. chlorid. mite,	1000	"
Ol. ricini,	300	" —M.

The plaster is to be melted, and to it added the calomel suspended in the castor oil.

This quantity is to be spread upon linen, so that fourteen strips, each nine feet by seven and three-quarter inches, are produced. Of

[1] "Ueber die Therapeutische Verwendung von Salben und Pflastermullpräparaten," *Berlin. klin. Wochenschrift*, No. 38, 1881, and "Die Medicamentösen Leime." *Aerztlichen Vereinsblatt*, 1886, No. 176.

[2] "Traitement de la Syphilis par le Sparadrap au Calomel," *Bullétin de la Société française de Dermatologie et de Syphilographie*, 1890, p. 63, *et seq.*

this plaster a square of two and a half inches contains 18 grains of calomel. Analysis of the urine of patients treated with this plaster showed the presence of mercury in from six to ten days. The plaster is to be applied over the region of the spleen, the skin having previously been carefully washed. It may be applied elsewhere upon the body, with a view to its general mercurial effect and also for the cure of local lesions. Quinquaud says that the use of this plaster is free from danger and inconvenience, and that by its use mercury is slowly and surely introduced into the system. My own experience with it is not large, but I regard it as a useful addition to our therapeutic measures.

Within the past decade a new method of treatment, which is really a modification of the inunction plan, has been introduced by Schuster of Aix-la-Chapelle,[1] and used by others. This method is by friction of the skin with a mercurial soap made in Paris and called *Savon napolitain*. A good lather is made with water and allowed to dry on the skin, upon which it leaves a thin film of mercury. This may be applied over a more or less extensive surface, but its too frequent application may cause dermatitis. The lather is less objectionable in odor and in feeling than the mercurial ointment; hence Schuster thinks this method is more elegant than inunctions. Improvement in cases of syphilis thus treated was noted, and chemical examination revealed the presence of mercury in the urine. Oberländer[2] endorses the method, but prefers a soap originated by himself, which is composed of one part of mercury combined with three parts of green soap, perfumed with oil of lavender. Oberländer claims that the lather made from this soap is of lighter color than that of the French preparation, and that it is actually absorbed into the skin, even without much friction.

Spillmann[3] advocates a soap made of pure olive oil and caustic potash, with which is incorporated 50 per cent. of mercury. This soap, which may be perfumed according to taste, is neutral in reaction and causes no irritation. A portion of the body is lathered with the soap, and after drying it is covered with thin paper or some suitable garment. After twenty-four hours the part is washed off and dusted with rice powder.

It may also be well to mention Dietrich's[4] mercurial soap, which is

[1] "Die Mercurseife, Savon napolitain," *Vierteljahr. für Derm. und Syphilis*, Heft 1, 1882.

[2] "Die Mercurseife ein Neues und Praktisches Ersatzmittel für die Mercursalbe," *Vierteljahr. für Derm. und Syphilis*, Heft 4, 1882.

[3] "Le Savon mercuriel comme succédané de l'Onguent napolitain," *Annales de Derm. et de Syphilographie*, 1885, pp. 496 and 497.

[4] "Sapo Unguiosus und Seine Anwendung als Salben Körper," *Monatshefte für Prak. Dermatologie*, 1887, p. 1068, *et seq.*

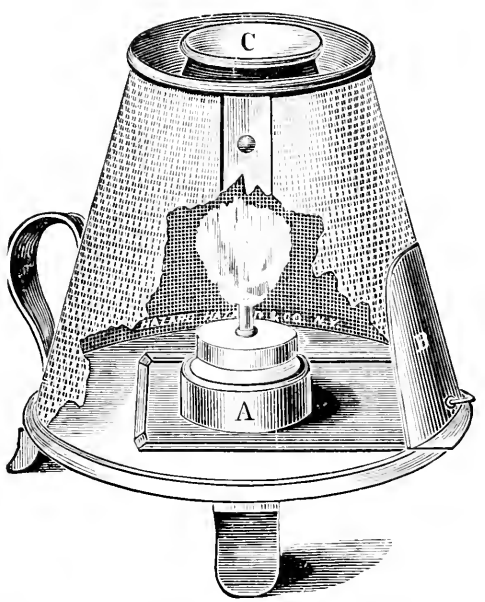
well thought of by Bronson. In my judgment the use of these soaps should be restricted to local or regional therapy.

Fumigation.

The mercurial vapor-bath is a method of treating syphilis which was revived and perfected by Langston Parker[1] and Henry Lee.[2] It is useful in very many cases and in many conditions of syphilis—not as a routine treatment, but as one of reserve and exigency. Many preparations of mercury have been used in this form of treatment, but calomel and cinnabar are the agents upon which experience has shown that most reliance may be placed. To obtain good and satisfactory results these drugs must of necessity be perfectly pure and free from admixture.

When calomel alone is used, from 20 to 40 grains may be placed upon the lamp, but in some urgent cases even 60 grains may be

Fig. 1.



This lamp is now made of wire gauze, and resembles the safety-lamp of the miners, thereby guarding against sudden explosions of the alcoholic vapors.

required. As a general rule, however, the smaller quantities are most serviceable, and they may be used over a longer period of time. The large doses of calomel administered by moist vapor are generally used in cases of severity and of exigency, and are not frequently

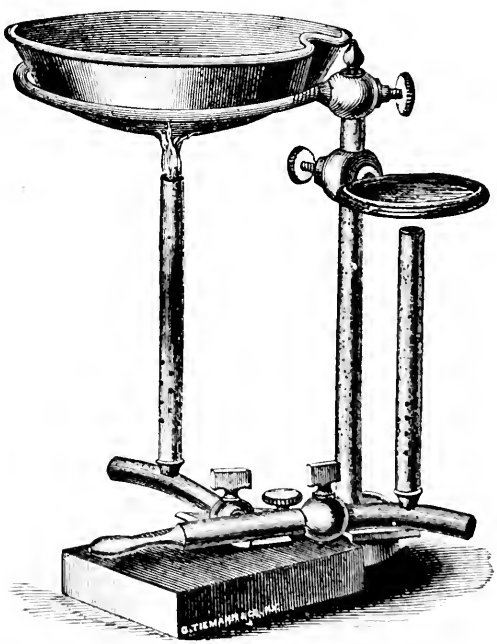
[1] *The Modern Treatment of Syphilitic Diseases*, London, 1871, p. 352, *et seq.*

[2] *Lectures on Syphilis*, Philadelphia, 1875, p. 93, *et seq.*

repeated. Cinnabar may be used in somewhat larger quantity than calomel, but in general my practice is to combine the two salts in one bath. As an average dose I have found that 15 grains of calomel and 20 of cinnabar fused simultaneously in connection with moist heat produce prompt and safe results. This dose may be increased or diminished according to the condition of the case. In large cities there are usually one or more establishments in which these baths are given under the advice of physicians. In that case the physician need only prescribe the dose and the number of baths which he desires the patient to take, and the bath attendants will carry out his wishes. Unfortunately, in some establishments the attendants, having a smattering of medical knowledge, think they know more than the doctor, and proceed to treat the case themselves. As Dr. Bumstead puts it, their "inherent tendency would seem to be to absorb the patient at the same time that he absorbs the mercurial fumes."

In some cases, when the baths are unobtainable or when the patients

FIG. 2.



Dr. Maury's apparatus for moist mercurial fumigations. It consists of two Bunsen's burners, one of which is surmounted by a pan to contain the water, and the other by a small shallow dish for the preparation of mercury. The apparatus is attached by means of a flexible tube to any ordinary gas-fixture.

object to go to the bath establishment, this method may be pursued at home. For this purpose it is necessary to procure the lamp designed by Mr. Henry Lee for fumigations (Fig. 1) or the apparatus invented

by the late Dr. Thomas F. Maury of Memphis. (Fig. 2.) The mercurial is placed in the cup *c* in Fig. 1, while the water is poured into the circular groove which surrounds the cup, about three or four ounces only being used. The patient is stripped and enveloped in one or more blankets or in coverings made for the purpose of mackintosh or India-rubber lined with flannel, and then the flame is started. In a few minutes perspiration is induced, and the evaporated calomel is deposited upon the body. Usually the protective garments fit closely at the neck, but in some there is a slight opening, through which some of the fumes may escape and may be absorbed in respiration. When deemed necessary by the physician the patient may breathe in some of the fumes, but it is always well to allow an admixture of air with them. Twenty to thirty minutes are sufficient for a bath, after which the patient is allowed to cool off slowly. When practicable the patient should retire at once to bed, preferably enveloped in the garment used in the bath. It is well, if the patient has to dress and go out, that as little friction of the skin as possible should be used, in order not to rub off the minute particles of mercury. In cold weather due care should be taken that the patient is properly protected when he goes out after the bath.

These baths should never be taken directly after meals. It is better that they should, if possible, be taken just before going to bed or in the evening, but in any case fully two hours should elapse after a meal. As a rule, patients should be in good condition as to their stomachs and bowels when they are subjected to this treatment, and they must be rigidly prohibited from using alcoholics. While undergoing mercurial vapor treatment the patient must be carefully watched in order that no drawbacks may be encountered. Thus if he complains of feeling tired and debilitated after a bath, it will be necessary to reduce the quantity of mercury and also the amount of water to be evaporated. In many cases harm is done by using too much steam vapor. Some patients complain of headache, and it is then necessary to administer a purge or to moderate the amount of food ingested.

It is well to begin by giving one bath every other day, and then to increase to a bath daily if the necessity of the case demands it. Some patients bear these daily baths well, while others experience unpleasant symptoms from them. As a rule, after one or two baths improvement is observed, but in some cases a beneficial effect is delayed for a week or two. The number of baths to be taken can only be determined by the condition of the case. In general it may be said that a course of baths extending over one or two months will be sufficient for that time. This period, however, may be lengthened. In many cases only a few baths are necessary, they being employed for some temporary condition or as an adjuvant to other methods of treatment.

While a patient is thus being treated the physician should carefully watch the state of his gums and of the gastro-intestinal tract, and remedy any disturbance. It is not uncommon to observe a mild form of mouth lesions in patients taking a course of mercurial baths. This condition may be cured by local means and by the temporary suspension of the baths or by diminishing the strength of the mercurial employed. Sometimes, when large doses have been frequently used, a sudden and violent colitis is developed. This condition, painful and sometimes alarming, is readily cured by rest, cessation of treatment, and the use of opiates.

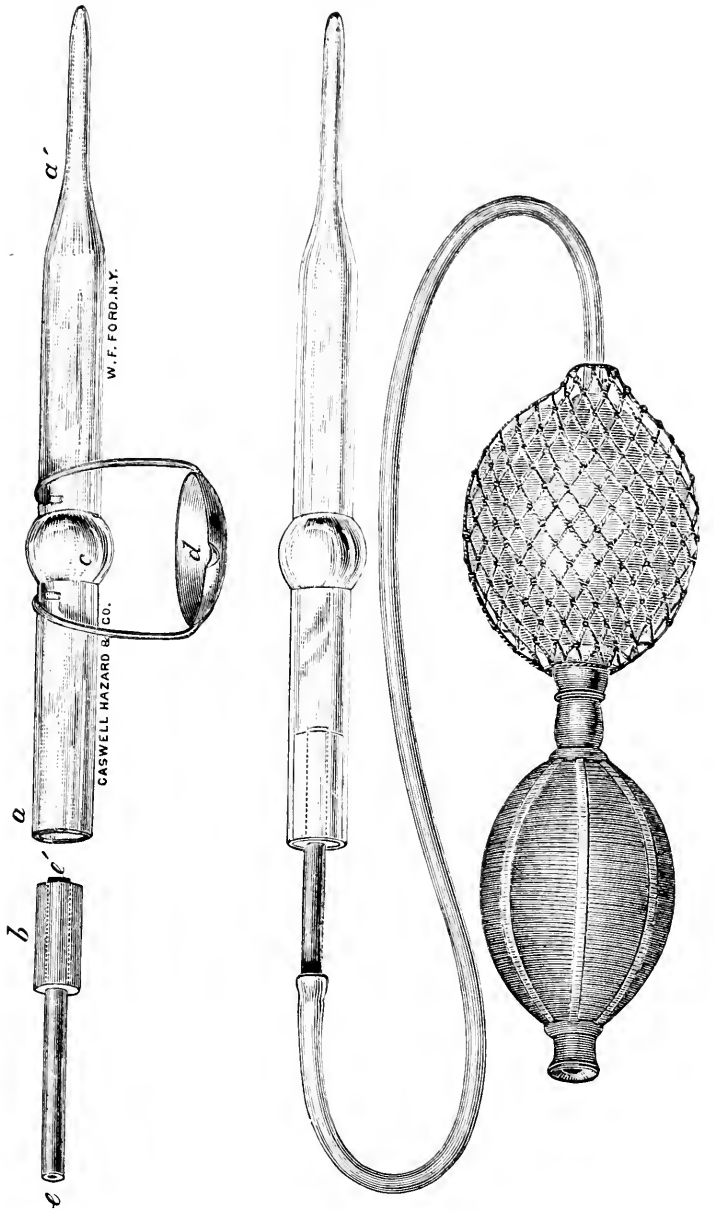
Mercurial baths are useful in the whole secondary stage of syphilis, and also in the tertiary period. They may be employed to remove some obstinate local lesion or to expedite the disappearance of a general rash. Late secondary rashes, rebellious to other methods, are frequently dispelled by this one with promptitude. Neuralgias, rheumatoid pains, cephalalgias, pains in joints and fasciæ are often promptly relieved by mercurial baths. In cases in which for any reasons other methods of treatment are contraindicated we can frequently resort to mercurial fumigations with marked benefit. In the section on Local Treatment the further indications for these baths will be considered. It sometimes happens that an eczematous tendency renders the use of mercurial baths impossible.

Local Mercurial Fumigation.—This method may often be employed with advantage when other applications have failed. Dr. W. S. Smith[1] has called attention again to the methods which he uses not only on the skin, but upon the lips, tonsils, and interior of the mouth and nose. Smith employs an apparatus devised by Dr. F. B. Kane.[2] (Fig 3.) This consists of a glass tube about ten inches long, drawn out to a fine nozzle at a', and cut off with a file at a, the edge being rounded off so as not to cut the cork b, and a slight bulbous expansion at c; the cork is made to fit a and holding tightly the small glass tube $c\,c'$ which passes through it, and a metal cup suspended by two wires about two inches under c. From 5 to 10 grains of calomel are introduced into the glass tube as far as the bulb on the point of a pen, the cork is inserted into the large end of the tube, and the end of the glass tube is attached to the rubber part of a spray apparatus, a small piece of rolled-up lint, or a small wire cylinder filled with asbestos and saturated with alcohol, is placed on the cup and then lighted. While the calomel on the bulb is being sublimed, a gentle current of air is forced through the tube. The result is the deposit of a film of sublimed calomel on the surface of the sore. The nozzle of the tube should be held at a distance of

[1] "Notes on the Treatment of Skin Diseases," *British Med. Journal*, May 7, 1881.

[2] "Mercurial Fumigation: Description of a New Apparatus," *Dub. Journal Med. Sciences*, Nov., 1874.

Fig. 3.



Apparatus for Local Mercurial Fumigation.

from one to three inches from the skin. The fumigation is easy of application, and harmless even on very sensitive parts. It causes no unpleasant results, and is usually not followed by salivation. I regard this as a very efficient therapeutic measure, and have seen many excel-

lent results from its use. It may prove of benefit in hereditary as well as in acquired syphilis, particularly in cases of obstinate ulcerative lesions and of phagedena in secondary or tertiary syphilis. Iodoform may also be volatilized in this way, and prove beneficial in the same class of lesions.

Dr. J. Hunter Wells[1] has proposed a very simple method of local fumigation for cases of syphilitic lesions of the palms. A hole large enough to admit the hand is cut in an ordinary hat-box, and from ½ to 1 drachm of calomel is put underneath on a tripod, and a spirit-lamp produces the fumes, which form a deposit on the hand.

Hypodermic Injections.

Within the past decade the use of mercury hypodermically in syphilis has been largely extended, and to-day this method is held in high repute by many physicians. As I shall show in the sections upon Corrosive Sublimate and Calomel, this method of employing these drugs is, within certain limitations as a measure of utility, reserve, and exigency, of marked benefit in many cases. It, however, should never be adopted as a routine treatment.

The chief claims of the advocates of the method by hypodermic injections of calomel and other mercurial salts, in preference to the older and more classic modes of treatment, are as follows:

1. It is simple, more exact, more convenient, and more expeditious.
2. It is applicable to all stages of the disease and to patients of all ages.
3. The practitioner remains the master of the treatment throughout.
4. It spares the patient's skin and stomach.
5. It ensures accuracy and precision of dose, and is attended with more rapid action and greater potentiality of the drug.
6. It is superior to, and less objectionable than, inunctions, and more permanent in its effects.
7. It is less liable to be followed by relapses, and gives the patient a greater immunity against the ulterior effects of syphilis than any other known method.
8. It effects a *cure* by the use of a minimum quantity of mercury, and at little expense.
9. It bothers the patients very little, does not necessitate change in mode of life or regimen, does not cause them to see their physician very often, and has the advantage of giving them a holiday of eight days, or more when calomel is used, during which they have no medicine to take or medical procedure to undergo.

These claims, it must be remembered, are made by enthusiasts, and

[1] "Injections in Syphilis, and a Handy Method for curing Syphilitic Palmar Psoriasis." *Medical Record*, May 13, 1891.

the reader must not be misled by their scope and boldness. It has been claimed that mercury thus administered has occult curative properties hitherto unknown, but of this there is really no evidence.

Within recent years much has been written eulogizing the effect of insoluble preparations of mercury, and there is at present a tendency to the disuse of the soluble preparations. It is claimed that the soluble salts of mercury are so rapidly absorbed and eliminated that their effect is less potent and much more ephemeral. On the other hand, it is claimed that insoluble preparations of mercury are slowly absorbed, are retained for long periods in the system, and that their effect is more active and prolonged. It is needless for me to discuss these questions here, for the reader can gain very clear ideas by a perusal of the following pages. In my judgment, the soluble salts of mercury are of much benefit in many cases, and their hypodermic use is not attended with the serious drawbacks and dangers incident to the use of insoluble salts hypodermically. In certain cases and with marked limitations insoluble salts, particularly calomel, thus used may be productive of benefit.

In former years injections were made into the connective tissue; to-day intramuscular injections (particularly of the insoluble salts) are largely in vogue. In my opinion, the innovation is neither beneficial nor necessary.

The extent of the literature of hypodermic injections in syphilis contributed within the past ten or twelve years is simply appalling, and in it there is really very little which is of practical value. In an essay like this, in which completeness is aimed at, it is necessary to give a survey of the progress made in the treatment of syphilis. To that end I have gone over and condensed this huge mass of literature, and I present an epitome of it here for what it is worth. It will be seen that almost every preparation of mercury has been experimented with in the hypodermic-injection treatment, and that the chemist's art has been sorely taxed to produce new preparations. Each new preparation has been exploited as the ideal of perfection, and in most cases a hearty welcome has been accorded it, so that a witty German reviewer has made the following paraphrase of an old maxim applicable to the subject: "*De novis nil nisi bonum.*" After all is said and done, the bare fact remains that corrosive sublimate and calomel are the two agents worthy of confidence, and they are not excelled in any way by any others.

For convenience of description, I will divide the preparations of mercury used hypodermically into the following groups: 1, the insoluble salts; 2, the soluble salts; 3, the so-considered antiseptic group; and 4, the amide group. Iodide of potassium, alone and in combination with mercury and iodoform, has also been employed subcutaneously, and the essential facts of its use will be presented.

INSOLUBLE SALTS.—*Calomel.*—Of the insoluble salts of mercury,

calomel is the one most extensively used and most uniformly efficient. Subcutaneous injections of the salt were first recommended by Scarenzio[1] in 1864, and in 1868 that author and his disciple, Ricordi,[2] published a pamphlet of ninety-nine pages in which they claimed brilliant results in the cure of syphilis. Since, at the present time, there is a revival on the part of some physicians in various countries of this method, it is proper that a synopsis of our knowledge should be here presented. Though this treatment, which has become known in medical literature as the method of Scarenzio, was used in Italy and in Germany principally by Sigmund, it had not, until within a decade, been tried, except in isolated instances, in other countries. In the year 1883 a Russian physician named Smirnoff[3] published a pamphlet in which he claimed to have modified and improved Scarenzio's method, and earnestly advocated its general adoption. In the year 1886 this author published a second pamphlet,[4] in which he laid greater stress upon his former claims. These writings of Smirnoff have resulted in a more general knowledge and employment of calomel subcutaneously in syphilis, so that to-day the method of treatment is accepted as a part of their armamentarium by a large number of observers.

Scarenzio claimed—and others have endorsed his view—that calomel introduced under the skin is acted upon by the alkaline chlorides of the blood, and slowly transformed into the bichloride, which in its turn is absorbed into the system. This author thought that 6 grains of calomel, administered in two injections at varying intervals (eight, ten, fourteen, and twenty-one days) into two different portions of the body—and he preferred the outer sides of the arms and thighs—were sufficient for a cure. In the early stages of the trial of this method it is stated that abscesses invariably followed the injections, but this complication was thought little of. Glycerin and mucilage of acacia were the vehicles in which the calomel was suspended.

The views of Sigmund[5] on the treatment of syphilis are generally worthy of close attention, and it is interesting to note that after a prolonged trial of Scarenzio's method he reached the conclusion that we can only assign very narrow limits to the employment of the hypodermic method, and can only recommend it in the milder and more simple forms of secondary syphilis. Sigmund saw very clearly that syphilis could not be cured in the rapid and high-pressure manner claimed by

[1] "Primi tentativi di cura della sifilide costitutionale," *Annali di Medicina*, Aug. and Sept., 1864.

[2] *La Méthode hypodermique dans la Cure de la Syphilis*, translated by Dr. Oscar Max. van Mons, Brussels, 1869.

[3] *Om behandling af Syfilis medelst subkutana Kalomel injectioner*, af Georg Smirnoff, Helsingfors, 1883.

[4] *Developpement de la Méthode de Scarenzio*, Helsingfors, 1886.

[5] *Vorlesungen über neuere Behandlungs weisen der Syphilis*, 3d ed., Vienna, 1883.

the Italian syphilographer, and in his employment of the latter's method he made radical modifications. Sigmund used smaller doses of calomel: instead of 3 grains injected once in eight days or at a longer interval, he used $\frac{3}{4}$ of a grain twice a week, and extended the treatment over a longer period. He preferred the sides of the chest and the belly as the sites of the injections.

In the light of existing knowledge of the treatment of syphilis by hypodermic injections of calomel, the following general summary may be given as to dose, technique, indications, and results:

The calomel must be perfectly pure and reduced by steam sublimation. Some authors go so far as to recommend that it be washed in boiling alcohol and dried. It may be suspended in pure glycerin, glycerin and water, mucilage of acacia, or in vaseline oil. Some observers use equal quantities of sodium chloride and calomel mixed in water. It is better that each dose should be freshly prepared, and in the weighing of the drug and in its trituration with pestle and mortar every precaution should be taken to prevent contamination. As a rule, 1 grain of calomel is sufficient for a dose; and this should be suspended in 10 or 12 drops of the vehicle used. In urgent cases 2 grains may be injected, but rarely is this much required. When the dose is mixed freshly for each injection it is necessary to prepare from four or five times the quantity.

In certain rare cases, particularly of lesions of the eye, ear, and cerebro-spinal system, in which a decided action was needed, I have employed injections of calomel suspended in water which contained chloride of sodium in solution. Krecke[1] has used this treatment on these lines in Strümpell's clinic. His formula is a good one, and is as follows: Calomel and chloride of sodium, of each 5 parts, to distilled water 50 parts. Of this liquid the contents of a Pravaz syringe may be injected every eight or ten days. This combination has been used by many observers, notably Rona, Matthès, Sterne, Neumann, Kopp and Chotzen, Dellen, and Finger.

Smirnoff is certainly correct in insisting upon thorough antisepsis in the administration of these injections; therefore I am careful to enter fully into the necessities of the technique. The hands of the operator should be thoroughly cleansed, and the parts to be injected should be washed with soap and water and scrubbed gently with a brush. After this they should be well saturated with a 5 per cent. carbolic solution, and then dried. The syringe must be kept perfectly clean, after having been rendered aseptic after its last employment. It should have a rather larger needle than usual, one having a calibre about twice as large as that of those generally used, and it should be nearly an inch

[1] "Ueber die Behandlung der Syphilis mit Subcutanen Calomel injectionen," *München. med. Wochenschrift*, 1887, No. 6.

and a half long. The working of the syringe should be easy and perfect, and its adjustment to the needle should be accomplished without hitch or delay. Previous to introduction it should be ascertained that no air has lodged either in the needle or the syringe. The injections are to be made at a right angle to the surface of the skin, and not in an oblique manner. The needle is to be slowly, but firmly, pushed in until the subcutaneous tissues are reached, and then the piston is to be very slowly pushed down. The idea is to produce as little violence as possible to these delicate tissues. Then the needle is to be carefully withdrawn between two finger-tips, pressing carefully but firmly on the injected spot. There is no necessity for light massage or for the application of plaster or collodion over the site of injection, though there is no objection to the latter.

The site of injection preferred by Smirnoff, Jullien, Watrasewski, Klotz, and others is the depression in the buttocks, an inch behind the posterior border of the great trochanter. Here the connective tissue is very lax and abundant, and pressure is not felt in any of the attitudes of our daily life. It is always better that patients should be selected who have but a moderate quantity of fatty tissue; therefore in very fat and closely-knit subjects fear of abscesses resulting from a want of diffusion of the injected fluid is to be entertained. In this limited area of course only a few injections can be made, but it is to be remembered that the advocates of this treatment speak of *cures of syphilis* by the use of *6 grains of calomel*. Other parts of the body may also be selected, but it should always be remembered that there must be plenty of loose cellular tissue, that bony prominences are to be avoided, and that places liable to be subjected to pressure during the day or in sleep must be spared. In some cases of active and grave intraocular, aural, and cerebral lesions the nucha, temples, and scalp have been and may be selected with advantage as sites of injection. Experience has shown that the thighs are prone to undergo abscess-formation from the injection of insoluble, and even soluble, preparations of mercury. Therefore, these regions, as well as the arms and forearms, should, unless under urgent circumstances, be avoided. I have found that injections of calomel and of corrosive sublimate may be made in the hypogastrium when care is taken not to go down to the groins or the mons veneris. The lateral portions of the chest have also been used, particularly by Sigmund.

By some it is advised that the patient should lie down when the injection is made, and it is a good rule in the administration of all forms of mercurial injection to place the patient in such a position that tension is not exerted upon the part to be injected. Though some observers state that they allow patients to go about their business after injection, I am strongly of the opinion that it is well for them to be

quiet for at least an hour or two, or to lie down for several hours if possible.

Until within the present decade calomel injections were made into the subcutaneous connective tissues, and this site of deposit is preferred by some authors. Following, however, a suggestion of Sofliantini, a disciple of Scarenzio, a number of experimenters have thrown the mercurial salt deep into the muscular tissue, where it is claimed in an acid medium absorption is more rapid and certain. In my own practice, with the limitations which I observe as to this method of treatment, I have always injected into the connective tissues, preferring to have a superficial to a very deep subfascial abscess if that unpleasant complication should develop. Whichever site of deposit is chosen by the physician, the greatest care must be observed to get the needle well into the soft tissues. It is very unfortunate to throw the injection into the deep corium; therefore the point of the needle should be well below this layer. An injection should never be thrown into the connective tissues over bony surfaces nor anywhere near the periosteum.

Symptoms of two varieties are observed after these injections—those which develop at once, and those which appear more or less remotely after the operation. In some cases pain in the track of the needle and in the injected focus is complained of. This symptom may be severe and it may be mild. It is often ephemeral in duration, and again it may last one or more hours. As a rule, women complain of it much more bitterly than men.

In some cases a disk of redness and inflammatory hyperæmia of the skin is seen around the point of puncture. If proper antisepsis has been attained, the inflammatory plaque in most cases gradually pales and disappears. If, however, any particles of dirt have been left in the track of the injection an abscess of that part is very apt to form.

Within a few hours or within a day or two in very many—I may say in most—cases a moderate swelling can be felt well under the skin at the injected focus. This nodule may be circumscribed and unattended with surrounding inflammation, or it may go on to the formation of a large and brawny swelling limited to the deep tissues, or perhaps complicated with inflammatory exudation into the derma. The onset of these sequelæ indicates the necessity of rest and quiet, and perhaps the use of cooling lotions. In some instances the nodules will gradually undergo resorption, but in very many softening takes place slowly after the subsidence of the immediate inflammatory symptoms. It seems to be the general opinion that when softening has occurred it is better to refrain from opening the mass, for even when marked fluctuation is felt resorption may occur, or at the worst the abscess will point and burst. In the latter event it rarely causes much trouble in healing, and very seldom leaves sinuses through the skin. These

abscesses may become encysted or they may undergo cheesy degeneration and subsequent absorption. Whereas before Smirnoff's time abscesses were of inevitable occurrence, with the improved technique of to-day they may be rendered very much less numerous than formerly. Even in Sigmund's experiments the number of abscesses was reduced.

To the eye these nodular masses when excised look like a cellular adipose lump saturated with a rather thick fluid of chocolate color, and in their centre a necrosed nucleus. According to Kopp and Chotzen, there were no bacteria found in the specimens examined by them. Under the microscope these calomel abscesses are found to contain blood, leucocytes, fatty matter and crystals of fatty acids, and the mercurial salt not yet absorbed. They are really necrotic and not septic abscesses. The fact of the absorption of the mercurial salt thus injected is proved by the prompt disappearance of syphilitic lesions and symptoms, and the demonstrable presence of mercury in the urine, fæces, and saliva. Balzer's observations, based on autopsies, go to prove that three weeks or a month are required for the absorption of the mercury.

Though it is claimed by the most ardent advocates of the calomel injections that salivation is not frequently produced, and even if developed that it is mild, according to my reading and experience this accident is not uncommon, particularly when as large a quantity as 3 grains have been injected every eight or ten days. The truth is, that one should be always on the alert and watchful of the condition of the mouth when these injections are employed. Salivation complicating this method of treatment may appear after the second or third injection, and, though rarely, even after the first. Cases are on record in which during a seemingly auspicious course of injections alarming salivation has set in. To explain this fulminating form of ptyalism the view has been expressed that the drug has had a cumulative effect, or that its absorption was slow at first, and that under unknown conditions it suddenly became very active and resulted in an explosion. Such facts carry with them their own teaching.

In the Paris hospitals, in the services of Besnier, Balzer, and Du Castel, enterorrhœa and colitis of varying degrees of severity and persistence have been observed. The imminence of these complications teaches us that we should never proceed in a bold manner in using these injections by throwing under the skin large quantities of calomel at short intervals. Cosati injected 8 grains of the salt, which caused a phlegmonous abscess, produced gangrenous stomatitis, and such a general morbid state that the patient nearly died.

Lesser[1] reports a case of mercurial erythema following a calomel

[1] "Ueber Nebenwirkungen bei Injectionen unlöshlicher Quecksilber verbindungen," *Vierteljahr. für Derm. und Syphilis*, 1888, p. 909, *et seq.*

injection. He further says that he has seen abscess less frequently follow the subcutaneous use of calomel than of yellow oxide.

Runeberg[1] reports the case of an anæmic woman, thirty-four years old, recently syphilitic, to whom three injections of $1\frac{1}{2}$ grains each of calomel were given at intervals of eight and twenty-four days, and who became so debilitated and suffered so much from diarrhœa and ulcerations of the mouth that she died. At the autopsy great destruction of the mucous membrane of the intestines and softening of the spleen were found. Vogeler[2] reports a case in which calomel injected deep into the glutei muscles produced such a severe abscess that an incision was required, together with free curetting of the walls. He further details a case in which salivation and diarrhœa, together with prostration and even collapse, were so severe that life was threatened. The patient was saved by opening the injected spots, scraping them out, and applying Paquelin's cautery. In a third case very alarming symptoms were only controlled by the adoption of this procedure.

The following case, reported by Kraus,[3] is worthy of attention: A healthy man, aged thirty years, was injected twice, with an interval of seven days, with $1\frac{1}{2}$ grains of calomel. He was soon after attacked with salivation, bloody diarrhœa, and anuria. He died on the sixth day after the last injection, and at the autopsy severe dysentery with perforation of the gut, diffuse bronchitis, parenchymatous nephritis, and ulcerative stomatitis were found. There was no urine in the bladder. Overbeck claimed that anuria is a symptom of mercurial intoxication.

Klotz[4] details a case in which, after a calomel-and-oil injection, his patient felt a sensation of heaviness in the leg near the spot injected, and was attacked with alternating chills and fever. He had severe pain in the left side of the chest, difficulty of breathing, and slight and painful cough. Examination showed a temperature of 102° Fahr. in the axilla and symptoms of pneumonia. In a few days the bad symptoms passed off. Klotz is led to think that "embolism into the lung of the oil forming part of the injected fluid had taken place." He speaks of another case in which similar phenomena, but of a milder character, were observed.

It is also well to remember the experience of Staderini[5] in the case

[1] "Quecksilber-intoxication mit toedtlichen ausgang nach subcutanen Calomel-injectionen," *Deut. med. Wochenschrift*, 1889, No. 15, p. 4, *et seq.*

[2] "Zur Behandlung der Syphilis mit subcutanen Calomel-injectionen," *Berliner klin. Wochenschrift*, 1890, No. 27, p. 940, *et seq.*

[3] "Ein Beitrag zur Kenntniss der Wirkung des Quecksilbers auf den Darm," *Deutsche med. Wochenschrift*, 1888, No. 12.

[4] "Clinical Observations on Intramuscular Injections of Insoluble Mercurial Salts in Syphilis," *Journal of Cutaneous and Genito-Urinary Diseases*, Feb., March, and April, 1890.

[5] "Injezione di calamelanos alla tempia, consequente embolia della arteria tem-

of a syphilitic man suffering from neuro-retinitis. This observer injected into the temporal region of each side of the head one gramme (15 grs.) of a 1 to 10 suspension of calomel, in order to bring the mercury as close as possible to the lesion, and thus to obtain the most active local effect. As a result, on one side a gangrenous spot was produced which laid bare the temporal artery and destroyed one of its two twigs. The author very properly calls attention to the small quantity of connective tissue in the temporal region, and to the firm, bound-down condition of the overlying integument. Injections, if used in these parts, must be made with the greatest care, and not in too large a quantity, and vessels must be avoided.

Scattered in the literature of this subject we find many claims of brilliant results and cures. Flarer by means of three injections of $1\frac{1}{2}$ grains of the salt cured a case of condylomata (gummy tumors) of the iris with posterior synechia. Scarenzio cured a case of cerebral syphilis with two injections, while iodide of potassium was taken internally. Soresina reports eight cases of specific eye diseases, such as complete paralysis of third nerve, keratitis punctata, retino-hyaloiditis, amaurosis, amblyopia, and neuro-retinitis, thus cured; while Stephanini produced brilliant results in a severe case of gummous infiltration into the pharynx. In eight cases Quaglino, by means of one, two, and three injections of 3 grains of calomel into the temporal region and arms, promptly cured paralysis of the third nerve, iritis, and keratitis punctata, retinitis, neuro-retinitis, and progressive atrophy of the optic nerves. Magri gives similar results in six similar cases, the injections being made into the temples and arms. Many other cases are to be found in medical literature in which conspicuously brilliant results have been claimed in the cure of the cerebral and ocular lesions of syphilis by Scarenzio's method. Sigmund's cures by this method were those of the mild, early manifestations of the disease, which of course readily yield to mercury administered subcutaneously, as indeed they would if the remedy had been given by the mouth. Smirnoff claims that he cured cases of tertiary syphilis, gummy tumors, tubercular, ecthymatous, and serpiginous syphilides, nocturnal pains, rheumatism, lesions of the bones, and insomnia. Other observers have failed to see benefit in the pains of syphilis, bone lesions, or insomnia. Smirnoff significantly remarks that if, during a course of injections in tertiary syphilis, aggravation of the symptoms occurs, they should be stopped at once, and that the iodide of potassium should be substituted. Klotz[1] claims very satisfactory results from calomel and yellow-oxide-of-mercury injections, administered to private patients for

porale superficiale e gangrene locale," *Bollet. del Soc. d. Cult. del Scienz med.*, 1887, 6; and *Vierteljahr. für Derm. und Syphilis*, vol. xix., 1156 and 1157.

[1] *Op. cit.*, p. 135.

primary, secondary, and tertiary lesions. It must be remembered that while patients are undergoing this method of treatment, as indeed under any form of mercurialization, they should be placed in the best possible hygienic conditions of all kinds. Though it is claimed that relapses are less frequent and less severe after this treatment than after any other, there is really no substantial evidence to prove the assertion.

It is also important to bear in mind that in old age, in cases of anæmia, of cachexia, of weak heart, of chronic visceral diseases in general, in persons having a bad state of the mouth and bad teeth, this treatment is contraindicated. Though the same ardent advocates consider it a method suitable for infants, young children, and pregnant women, I am far from their way of thinking.

From an experience of this method of treatment dating over twenty-five years (having seen the original trials of it by my colleague, Dr. Bumstead, in 1866), and from a study of all that has been written upon it, I can but reiterate what I have often said in medical debates—that it is a method of treatment of utility in emergency. It may prove useful in some cases spoken of elsewhere in this essay, such as those of ocular, aural, and cerebral syphilis, when given very cautiously and only in a few doses. That it never will be used as a systematic treatment extending over a period of years, as Neisser and Leloir suggest, I am firmly convinced. It is a treatment which is generally irksome and repulsive to patients, always attended with more or less discomfort and pain, and often producing destructive subcutaneous lesions over the body, which cause mental and physical suffering, and which of necessity must impair the patient's health and strength. In some cases, as we have seen, it has been known to imperil and to destroy life.

In the foregoing section prominent mention has not been made of the combination of calomel with oil of almonds, olive oil, or oil of vaseline. The clinical facts relating to this modification of Scarenzio's method can be more clearly and briefly brought out as an addendum to the section upon gray oil as a remedy in syphilis.

METALLIC MERCURY.—The administration of metallic mercury has not been extensively tried in the treatment of syphilis, and it must be confessed that the advantages claimed by those who have thus employed the agent are not conspicuously brilliant. Fürbringer[1] was, according to my reading, the first to inject metallic mercury under the skin, using the following liquid: mercury, 2 parts; mucilage acacia with glycerin, 10 parts; of which the dose is the contents of a Pravaz syringe. At the time of injection little pain is experienced, but in

[1] "Zur localen und resorptiven Wirkungweise einiger mercurialien insbesondere des subcutan injicirten Metallischen Quecksilbers," *Deut. Archiv für Klin. Med.*, 1879, 24, p. 129–157.

about twenty-four hours symptoms of inflammation appear, which may end in abscesses. If the skin is rubbed after these injections mercury may frequently be found in the urine quite early, but when simply deposited under the skin it may there remain and produce no effect. Fürbringer thinks this method of treatment should only be used when inunctions are contraindicated and when the mercurial is not well borne by the mouth. To Luton,[1] however, belongs what credit there may be in another innovation in the employment of metallic mercury in syphilitic therapeutics. This observer claims that if mercury in its pure state be injected into the muscular tissues, it will there undergo peptonization and digestion by means of the acid fluids. In a limited experience of these injections he found that syphilitic patients grew fat, and that their disease was favorably influenced.

Prokhoroff[2] states that he has thus treated forty cases, and that he considers this method of treatment superior to inunctions or to injections with any other mercurial. He injects from 6 to 30 grains (0.5 to 2.0 gm.) of the metal at a time once a week, and employs hot baths to accelerate absorption. Symptoms promptly disappeared and no toxic effects were produced. Prokhoroff thinks that the mercury traverses the system in a pure state in the form of very minute particles.

Iakovleff[3] used from 5 to 20 grains of pure mercury in weekly injections, which were followed by daily kneading and rubbing of the injected spot and by hot baths every two or three days. This author claims a minimum number of relapses in cases in which on an average 83¾ grains of metallic mercury were injected over a period of ninety-three days. The pain is said by him to be trifling, and to disappear quickly under local massage and hot baths, and indurated nodules and abscesses were not produced. Iakovleff mentions the fact that in cases previously treated by frictions mercurialism appeared after these injections.

Von Düring[4] also injected pure mercury into the buttocks of seven patients, using one-half the contents of a Pravaz syringe, more or less. When small doses were injected the effect was delayed, but large doses were promptly followed by such severe mercurial intoxication that excision of the injection-nodule in the glutei muscles was rendered necessary. In a patient injected in the forearm a movable, sharply-defined, fluctuating tumor of the size of a pigeon's egg was formed, and over it the skin was of a deep red and traversed by sinuses, through which metallic

[1] "Des Milieux hypodermiques," *Archiv. gén. de Médecine*, 1882, vol. ii. p. 526, *et seq.*

[2] *Vratch*, No. 40, 1887, p. 766.

[3] *Proceedings of the Riga Russian Med. Society*, 1889, p. 87; and *British Journal of Dermatology*, 1889, vol. i. p. 481.

[4] "Die Einwirkung des Regulinischen Quecksilbers auf tierische Gewebe," *Monatshefte für Prak. Dermatologie*, Nov., 1888, p. 1059, *et seq.*

mercury, but no pus, exuded. The microscopical examination of this mass when removed showed a picture strikingly resembling spindle-celled sarcoma. Von Düring therefore thinks that metallic mercury is unsuitable for subcutaneous injection, for the reason that small doses act too slowly, while large ones are apt to produce too intense and continuous an action. On the other hand, the following case of Augagneur seems to prove that mercury may become encysted, and from time to time be absorbed into the system. Augagneur's[1] case presented a tumor of the thigh which followed two injections of metallic mercury. A peculiarity of the case was that intermittent salivation occurred, and that on one occasion it seemed to follow a blow upon the thigh. The tumor was very large, and an incision into it down to the muscle revealed the fact that a great part of the mercury injected had not been absorbed.

OLEUM CINEREUM, OR GRAY OIL.—Oleum cinereum, or gray oil, is a semifluid, fatty, mercurial liquid introduced into medicine by Professor E. Lang of Vienna in 1886.[2] This author claimed exceptional merit for this therapeutic agent, and in his last essay,[3] after an experience of five years in its use, he states that his earlier convictions have been strongly confirmed. It is urged that this oil is well borne, and that the usual drawbacks to the use of mercury are very slight, and that even when they do occur they are mild and ephemeral in character. Lang considers this combination to be superior to mercurial frictions. Before it is used upon patients, however, he insists that the condition of their mouth and teeth shall be carefully attended to.

Gray oil is prepared as follows: A given quantity of lanoline—say 1 or 2 drachms—is rubbed up with considerable chloroform to emulsify it. This mixture is to be thoroughly triturated, during which operation the chloroform will evaporate. While, however, the mixture is still in a fluid state, metallic mercury to the amount of double the quantity of the lanoline is to be added, and the trituration further kept up. As a result, a pomade of mercury is left, which represents mercury two parts and lanoline one part. This is called strong lanoline gray ointment. From this salve-basis a 50 per cent. oleum cinereum or gray oil may be obtained by mixing three parts of it with one part of olive oil. A mild gray lanoline ointment may be made in the same manner as the strong by taking equal parts of lanoline and mercury and thoroughly mixing them. From this salve-basis a 30 per cent. gray oil may be made by mixing six parts of it with four parts of fresh almond or olive oil.

[1] "Tumeur d'origine thérapeutique de l'injection de mercure metallique," *Lyon Médical*, Mar. 30, 1890, p. 455.

[2] "Zur Syphilis-therapie," *Wien. med. Wochenschrift*, Nos. 34 and 35, 1886.

[3] "Behandlung der Syphilis mit Subkutanen Injectionen von grauen oele," *Ibid.*, Nos. 48 und 50, 1889.

Lang uses, therefore, two forms of gray oil, the one containing 50 per cent. and the other 30 per cent. of mercury. These preparations should be kept in small quantity in glass-stoppered bottles and in a cool place. With care they may be kept in perfect condition for many months.

Neisser[1] uses a modification of Lang's gray oil, made as follows: Mercury, twenty parts; ethereal tincture of benzoin, five parts; and liquid vaseline forty parts. This compound should be thoroughly triturated for a long time (care being taken that an aseptic condition is observed) until a homogeneous liquid is produced. This observer thinks that the gray oil has a large sphere of usefulness, and that it may even be used during pregnancy.

Balzer[2] and Reblaub have used Neisser's gray oil in preference to that of Lang, but were not very favorably impressed with its results. They noted pain and tumefaction after the injections into the buttocks, and that a lameness was produced which passed off after rest.

Althaus[3] has lately advocated for the treatment of syphilitic nervous affections a modification of Lang's gray oil, made as follows: Metallic mercury, one part; pure lanoline, four parts; and five parts of a 2 per cent. carbolic oil. This is said to be a homogeneous gray cream which has no tendency to decomposition. The dose is about five minims for an injection.

It is always necessary to warm the gray oil, either over a spirit-lamp or in hot water, and then thoroughly shake it before using it. Lang injects three-quarters of a grain (0.05) to one grain and a half (0.1) of the 50 per cent. solution twice in the first week in two places, and half as much the next week. Such is the claimed enduring efficacy of the remedy that Lang does not administer another injection for two or four weeks. Double the quantity of the 30 per cent. solution may also be employed. In the subsequent injections Lang is explicit in stating that they should not be made stronger, but that they may be given at various intervals, according to the urgency of the case, of one or two weeks indefinitely. It thus happens that no pause, as indicated just now, is observed, but that a continuous treatment is followed. Increased rapidity of action is produced by making injections into two spots, and a more enduring action results than from one injection of a similar quantity. Lang says that his treatment may be used according to the views of the experimenter, either continuously, by intermissions, or even symptomatically. He speaks of its efficacy in

[1] Harttung: "Die Verwendung des oleum cinereum benzoatum (Neisser) zur Syphilis-behandlung," *Vierteljahresschrift für Dermatologie und Syphilis*, 1888, p. 367, *et seq.*

[2] "Traitement de la Syphilis par les Injections intramusculaires d'huile grise benzoïnée," *Bulletin Médical*, No. 74, 1888.

[3] *The Treatment of Syphilis of the Nervous System*, London, 1891.

local and regional therapy, in cases of circumscribed infiltrations, and of ganglionic enlargement.

In the nervous affections of syphilis and the neurasthenia produced by that disease Lang claims that injections of gray oil are most efficacious, and that a notable improvement in appetite and health is soon experienced.

The sites of injections are the back, a few inches on each side of the spine, begining about the scapula and ending at the buttocks. In the regional therapy the injection should be made near the lesion to be acted upon. The injections are made into the subcutaneous connective tissues.

Certain observers, notably Hallopeau and Kaposi, have reported cases of very alarming mercurial intoxication (great asthenia and intractable colitis) as being caused by injections of the gray oil. In his latest communication Lang analyzes these cases in full, and claims that they resulted from an excessive and intemperate use of the mercurial compound, and that they should not stand as evidences of its dangerous character.

It is claimed by Lang that local pain is seldom caused by these injections, and that when it exists it is mild in characrer; also, that little if any inflammatory œdema or infiltration of the tissues is produced. In these assertions he is borne out by Trost,[1] who instituted comparative tests between gray oil and a lanoline-olive-oil combination of calomel. On the other hand, Lindstroem[2] of Kiev states that Lang's injections are slow in action, attended with relapses, accompanied and followed by pain, and frequently give rise to diffuse infiltrations. Stomatitis is frequent and severe, and accompanied by profound anæmia and diarrhœa. Lindstroem further says that these injections may give rise to embolism—that in one case he observed a consecutive paralysis of the right side of the face, and in another intense œdema of the right upper limb and pneumonia of the right side. If, now, we compare the drawbacks noted as following injections of calomel and gray oil, we may reach the conclusion that, notwithstanding all that is said in their favor, they sometimes give rise to very unpleasant symptoms, and rather exceptionally to conditions which threaten and even compromise life. Therefore, I think that their use should be restricted to well-selected cases in which other remedies are contraindicated or are impracticable of employment. When used much care and observation is required of the person who administers them. In my reading I have been struck forcibly by the fact that the most serious results have

[1] "Ueber das Oleum Cinereum im Vergleiche zur den Calomel-präparaten," *Wiener med. Wochenschrift*, 1888, No. 38, p. 1374, *et seq.*

[2] "Treatment of Syphilis by Subcutaneous Injections of Oleum Cinereum," *Meditzinskoie Obozrenië*, 1890, xxxiii. p. 7, *et seq.*

almost invariably followed injections in which fatty matters have been the vehicle of suspension. Then, besides the cases already cited, the case of Lesser[1] may be mentioned: A man, thirty-eight, had received five injections of a minute quantity of tannate of mercury in olive oil, and after the last one the patient was seized with a convulsive cough and became cyanotic. He then had diarrhœa and dulness at the base of his lung, with crepitant râles and rough breathing. He luckily escaped with his life. Therefore I think that these methods of treatment should never be largely employed as routine therapeutics.

It may be of interest to add that Watrasewski recently reported that he had made experiments upon animals which convinced him that injection of oily substances without the addition of mercury may give rise to embolism of the lung. In the section on Calomel Injections it is noted that Klotz had such an experience after a calomel-oil injection. It is certain, therefore, that there is danger in hypodermic medication when the mercurial is suspended in any other substance or liquid.[2]

Yellow Oxide of Mercury.—The yellow oxide of mercury owes its introduction into the therapeutics of syphilis to Watrasewski,[3] whose zealous advocacy of its worth has been the means of its quite extended adoption. Of all mercurial preparations, it is the salt to-day most generally used hypodermically, having largely replaced calomel. Watrasewski had used calomel on a large scale, and was led to abandon it by reason of the many drawbacks to its use (see section on Calomel), and chiefly by reason of the intense pain caused by the injection of it, and of the weakness, fever, diarrhœa, want of appetite, and insomnia which it produces. His formulæ are as follows:

No. 1. ℞.	Hydrarg. oxid. flav.,	gr. xxij;
	Acaciæ,	gr. iv;
	Aq. destillat.,	f℥j.—M.
No. 2. ℞.	Hydrarg. oxid. flav.,	gr. xv;
	Acaciæ,	gr. iv;
	Aq. destillat.,	f℥j.—M.

He begins with the second or milder solution, and injects a Pravaz syringeful. Three to six injections are sufficient for a cure, which, it must always be remembered, means, in the minds of most exploiters

[1] *Op. cit.*, pp. 913–915.

[2] *Op cit.*, p. 135.

[3] "Ueber Behandlung der Syphilis mit Injektionen von Kalomel und Quecksilberoxyden," *Wiener med. Presse*, 1886, Nos. 42 and 44; "Ueber die Behandlung der Syphilis mit Injektionen unloslicher Quecksilber-Salze," *Monatshefte für Prak. Dermatologie*, 1887, p. 989, *et seq.*; "Étude comparative sur l'Effet thérapeutique des Injections mercurielles insolubles dans la Syphilis et sur les Accidents qui peuvent accompagner leur emploi," *Journal des Mal. cutanées et syphilitiques*, 1890, vol. i. p. 193, *et seq.*

of hypodermic mercurial preparations in syphilis, the disappearance of a given set of symptoms or lesions.

The yellow oxide of mercury is promptly absorbed, and its presence can be detected in the urine within a day or two. It seems to linger in the system also, and whereas many of the mercurial preparations soon disappear from the urine upon the cessation of the injections, when the yellow oxide is discontinued mercury, according to several observers, may be found in the urine for three weeks or more. The usual claims are made by Watrasewski as to the prompt action, the mild and ephemeral local reactions, and the comparatively rare occurrence of mouth and intestinal complications after injections of yellow oxide.

Many observers have used Watrasewski's salt, and speak in high terms of it, among them Dr. Klotz of New York.[1] Rosenthal[2] endorses its use quite warmly, and considers it next to inunctions in value. This observer used the following formula:

℞. Hydrarg. oxid. flav.,		gr. vij;
Ol. amygdal. vel olivæ,		f℥ss.—M.

Of this the dose is 30 minims, injected every eight days into the glutei muscles.

Kuhn[3] put this agent to the test in comparison with calomel. He concludes that it is less active than that salt, but has the advantage of being less painful, of causing mild and ephemeral indurations, and being attended with no local or constitutional complications. Tchernogüboff[4] employed the yellow oxide, using one or two injections of 2 grains each, into the cellular tissues in early cases, at intervals of eleven days, and in older cases at longer periods. This observer, as will be seen, uses large doses, and says that they are beneficial in tertiary syphilis and in early gummata. Men and women, it is claimed, bear these large doses well, and children are said to be benefited by doses of 1 grain. Tchernogüboff thinks this remedy is contraindicated in anæmia, exhaustion, alcoholism, and visceral diseases. Perhaps it may be well to add that any mercurial preparation should be used with great caution in patients suffering from these grave disorders.

Tchernogüboff[5] also uses this preparation in doses of 2 grains

[1] *Op. cit.*, p. 99.

[2] "Die Behandlung der Syphilis mittelst Einspritzung, von Hydrarg. oxyd flav." *Vierteljah. für Derm. und Syphilis*, 1887, p. 1101, *et seq.*; and "Allgemeine Gesichtspunkte bei der Behandlung der Syphilis mittelst Quecksilbereinspritzungen, *Ibid.*, p. 1107, *et seq.*

[3] "Zur Behandlung der Syphilis mit Injektionen von Hydrarg-oxyd-flav. im Vergleiche züm Calomelöl," *Deut. med. Wochenschrift*, 1888, p. 635, *et seq.*

[4] *Lancet*, Oct. 12, 1887, p. 757.

[5] *Transactions of the Third General Meeting of Russian Medical Men*, No. 5, p. 160, St. Petersburg, 1889.

every ten or eleven days, injected into the muscles. He says that syphilitic children from twelve to fourteen years old tolerate one-grain doses hypodermically very well, and are benefited. He thus treated 120 cases, male and female, young and old, without any untoward complications. It is interesting to remember that Lesser[1] observed abdominal pains, vomiting, and bloody and mucoid diarrhœa after injections of yellow oxide, and never after calomel. The conclusion, therefore, is warranted that we can only get at the truth as regards the the advantages and drawbacks peculiar to any and all preparations by a study of the experience of many men. It is never well to rely fully upon the assertions of the exploiter of a new mercurial preparation or combination. Thus we find that Dampekoff[2] used the yellow oxide upon 179 syphilitic women, and that neither intense pain nor suppuration was produced. Yet these women absolutely refused to allow the continuation of the treatment by reason of the severity of the pain. Then, on the other hand, Reshetnikoff,[3] in the course of 1800 injections of yellow oxide suspended in vaseline oil and made into the gluteal regions, never met with an instance of local suppuration, and only once saw a diffuse sanguinolent infiltration, which disappeared without any bad result. A quite recent essay on the value of yellow oxide of mercury hypodermically in syphilis is contributed by Selenew,[4] of Stükovenkoff's clinic in Kiew. This observer reaches the conclusion that this treatment is to be preferred to all others as offering a more energetic and more prolonged influence of the mercurial upon the syphilitic virus. Selenew thinks that cerebral lesions, old age, exhaustion, anæmia, and alcoholism are not contraindicating conditions to its use. He noted a mild character in the sequelæ of the injections, and occasionally a mild and ephemeral rise in the temperature.

My own conclusion as to this agent is that in certain exceptional cases, where regional or local mercurial therapy is required, it may be, if used carefully, of decided benefit. I have no leaning to the routine use of any insoluble salt of mercury employed hypodermically.

Many other contributions upon the use of the yellow oxide of mercury have been published, but they contain nothing more than has been here presented.

Black Oxide of Mercury.—Black oxide of mercury, used largely in homœopathic practice, has been extolled as a remedy for

[1] *Op. cit.*

[2] *Dnevnik Kazanskaho Obshtchestva Vratchei*, Jan. and May, 1889, p. 11; and *British Journal of Dermatology*, vol. i., 1889, p. 381.

[3] *Vestnik Obshtch. Hygh. Südebnoi i Praktitcheskoi Meditziny*, Jan., 1889, p. 1–17; and *British Journal of Dermatology*, vol. i., 1889, p. 349.

[4] *Meditzinskoie Obozreniĕ*, 1890, p. 1; and *British Journal of Dermatology*, vol. ii. p. 190.

syphilis when administered subcutaneously. Abend[1] used a suspension of this drug in gum and water, employing in all six hundred and eighty-three intramuscular injections, of which two to fourteen are necessary in each case. He noted the early disappearance of secondary and tertiary lesions. Pain and infiltration were moderate, there were no abscesses, and rarely was stomatitis observed.

Hartmann[2] also claims for the black oxide especial advantages. He used the following formula:

℞. Hydrarg. oxidi nigri, gr. xv;
Glycerini,
Aquæ destillat., āā. ʒiss.—M.

Of this the contents of a Pravaz syringe should be injected into the buttocks.

Hartmann also uses a 10 per cent. oil emulsion. Three to six injections are considered sufficient. They produce some pain, slight irritation, and sometimes stomatitis. It is claimed that this drug is indicated in the treatment of hereditary syphilis.

Watrasewski also used both black and red oxides of mercury in a 10 per cent. gum solution. He found that they exhibited considerable action, comparable to that of calomel, but that they caused less pain than that drug. He thinks that the oxides mix more readily with liquids than calomel. The resulting nodosities are smaller and less lasting than those produced by calomel.

It need only be mentioned that protoiodide of mercury, tannate of mercury, red oxide of mercury, sulphate of mercury, and turpeth mineral have all been tried hypodermically in syphilis, and their promoters have usually found them efficacious. The truth is, that they all come under the head of insoluble salts, and none of them possess any advantage whatever over calomel, while some are more irritating and others less efficient.

Cinnabar.—Cinnabar (hydrargyrum sulphuratum rubrum) is considered by Dr. A. A. Sükhoff of Cronstadt the best mercurial preparation for subcutaneous use. He prefers the so-called artificial cinnabar, a fine bright-red salt, which mixes very evenly with oil of sweet almond. One drachm of the powder is mixed with an ounce of oil of sweet almond, and of this one syringeful, representing about one and a half grains of the agent, is injected into each buttock every one or two weeks. The average number of injections required varies between two and ten, and the sojourn of the patients in the hospital averaged between

[1] "Behandlung der Syphilis durch Subcutanen Injectionen von Hydrargyrum oxydulatum nigrum," *Inaugural Dissertation*, Würzburg, 1887.

[2] "Behandlung der Syphilis mit Injectionen von Hydrarg. oxydulatum nigrum," *St. Petersburg med. Wochen.*, 1890, 3.

twelve and forty days. Sükhoff[1] claims that these injections are painless, and cause no local or general reaction, and that they are suitable for ambulatory cases. He makes the significant remark that in rare malignant forms of syphilis this agent is less energetic than the classical mercurials.

Corrosive Sublimate.—Though Hebra[2] in 1861 employed hypodermic injections of corrosive sublimate upon two cases of syphilis, and Berkeley Hill[3] in 1866 upon eleven cases, it was not until after the appearance of the monograph of Lewin[4] of Berlin upon the subject that this mode of treatment took a prominent place in the therapeutics of syphilis. The first important contribution to this subject published in France was by Liégois,[5] and after this very many articles appeared in various countries detailing the experience, favorable or the reverse, of different observers. In 1871, I published the results of my experience[6] in the treatment of 50 cases of syphilis by this method, and I have employed it since within the limitations yet to be brought out. From the experience of many observers it is made clear that doses of from $\frac{1}{12}$ to $\frac{1}{4}$ of a grain of this salt, dissolved in from 10 to 15 drops of distilled water, injected into the subcutaneous tissues, have a prompt effect upon secondary syphilitic manifestations. Whereas in earlier days the claim was made that this treatment was applicable to all forms and stages of syphilis, the conviction has gradually gained ground that it is a method (valuable in very many instances) of reserve, emergency, utility, or expediency. Thus in cases in which mercury is badly borne by the stomach, and by that method acts as a depressant and impairs nutrition, it is very common to observe that these injections are well borne, and that an era of improvement is inaugurated. Again, in cases of intestinal disorder, in which pain and diarrhœa always follow the stomach-dose, the subcutaneous injections come to our aid. In many cases when by stomach ingestion a mild or severe stomatitis or salivation is produced, or when local medication is powerless, the substitution of hypodermic injections will often be followed by full toleration of the drug. The injections are often of much value in local and regional therapy, as, for instance, in

[1] "Treatment of Syphilis by Injection of Cinnabar," *Protok. R. sch. Sjf. i Dermat. Obst. St. Petersburgh*, 1890, iv. 51–57.

[2] "Ueber die Behandlung der Syphilis," *Allgemeine Wien. med. Zeitung*, July 23, No. 30, 1861.

[3] "Subcutaneous Injection of Mercury in Syphilis," *Lancet*, May, 1866.

[4] *Behandlung der Syphilis mit subcutanen Sublimat-injectionen*, Berlin, 1869.

[5] "Des Resultats cliniques et scientifiques obtenus avec les Injections sous-cutanées de sublimé a petites doses," *Annales de Dermat. et de Syphiligraphie*, tome 2, 1869–70, pp. 1, 90, and 272.

[6] "On the Treatment of Syphilis by the Hypodermic Injection of Corrosive Sublimate," *Medical Gazette*, May 13, 1871.

cases of localized syphilitic neoplasms, resisting internal treatment, in eye, ear, and cerebral affections, and hyperplasia of the lymphatics and the ganglia. In the past two winters I have often derived much benefit from the hypodermic injection of corrosive sublimate in patients who were suffering from the grip, and in whom the secondary manifestations of syphilis coincidently showed themselves. In many of these cases mercury by the stomach was badly borne and produced debility and great nervousness; in others the stomach was fully taxed by the antigrip remedies; and in still others it seemed to have no effect. In these conditions I resorted to the sublimate injections, with a promptly beneficial effect and ultimate good results upon the syphilitic diathesis. It is well to bear these facts in mind, for they will be the means of helping many a sorely-tried patient over some very rough spots.

In many cases of secondary syphilis it will happen that by reason of colds, of intercurrent late acute affections of the lungs, liver, and intestines, and of gastric derangements, mercury by the mouth is temporarily contraindicated; and in these exigencies a resort may be had to hypodermic medication. Patients sometimes become tired and complain of the dosing by pills, and circumstances do not favor the use of inunctions or fumigations; and in these cases very often quiet and contentment may be produced by using the mercury subcutaneously. In some cases, happily rare, the evolution of the secondary period of syphilis is ushered in with fever and deep debility; in fact, a pseudo-typhoid state is produced (*typhose-syphilitique* of Fournier). In such cases there is very often stomach intolerance of mercury, and the patient is too weak to stand mercurial inunctions. In this emergency we can use hypodermic injections of sublimate with confidence, and employ the stomach for symptomatic remedies. Even at this late day I think I can do no better than quote in the main the conclusions—somewhat modified and elaborated, however—which I reached upon this subject in 1871. They are as follows:

1. That the use of bichloride of mercury by hypodermic injections, though a method of treatment possessing certain advantages, is for various reasons of limited application. 2. It is useful in the whole secondary period of syphilis, in roseola, in the papular syphilides, and in the small miliary pustular syphilide. Its action upon newly-appearing syphilides is sometimes almost marvellous. This effect is always strikingly well marked upon lesions in the vicinity of the injections, which disappear in a few days Thus in cases of disfiguring and compromising syphilitic eruptions on the face, neck, or hands, these injections, made as near as possible to the seat of the lesions, will always bring about a prompt and satisfactory result. When syphilides have grown old, they are often slow to yield to these injections, which have little if any effect upon scaling lesions, whether of early or late

evolution. 3. It very rapidly cures all syphilitic neuroses, cephalalgias, pleurodynias, and angina, even when they are slow to yield to the internal use of mercury and morphine. 4. In the cachexias of syphilis, early and late, and in the anæmia with concomitant gastric weakness, these injections, used for a time as a treatment of utility, will prove very efficacious. 5. It possesses no advantages over other methods in the treatment of mucous patches and condylomata lata, or in the hard œdema accompanying primary or secondary lesions. 6. It may be beneficial in the mild and even severe forms of cerebral and spinal lesions, in combination with iodide of potasssium internally, particularly in those cases in which the use of mercurial frictions is for any reason impossible. Under like conditions in eye and ear syphilis these injections may be resorted to. 7. In the early tertiary lesions, and even in the late forms if not of an ulcerated character, these injections are often beneficial, but they then require the internal use of the iodide of potassium as an adjuvant. 8. This treatment is frequently well borne by men, but is much objected to by women as a rule, and in children and infants it is contraindicated except under conditions of severe emergency.

Rosolimos,[1] who has used sublimate injections upon a large scale, calls attention to a fact which I have also observed—namely, that the method is often extremely efficacious in cases of buccal lesions without the aid of topical treatment. He attributes this efficient action not only to the curative influence of the injections, but also to the fact that they very rarely, if ever, cause stomatitis or any form of mouth lesions, which so often lead to the development of syphilitic processes on these parts.

It is of the utmost importance that the patient should be not only intelligent, but at the same time impressed with the gravity of his disease, in order that he may comprehend the advantages he is to derive, otherwise he will not submit to the pain and inconveniences of the treatment. In some cases in private practice the treatment is inadmissible by reason of the cost of the frequent injections. In dispensary practice patients soon tire of this treatment, and they fail to appear for its continuance. It is well, therefore, for physicians not to put down in their records cases as being cured for the reason that they did not come back, since it is very probable that they may have sought other and more agreeable methods of treatment.

Within the limits of expediency, emergency, and utility these injections possess the advantages of smallness and precision of dose and ease of administration, a promptly satisfactory therapeutic action, and the absence of systemic disturbance.

[1] "Les Syphilides secondaires de la Bouche, traitées par les Injections mercurielles," *Annales de Derm. et de Syph.*, 1888, p. 525, *et seq.*

The quantity of mercury for initial injections should be about $\frac{1}{10}$ or $\frac{1}{8}$ of a grain of the sublimate for persons in good health. In weakly individuals $\frac{1}{12}$ of a grain may be used. Therefore it is well to have several solutions on hand, always in small quantity, kept in a cool place and secluded from the light. After many years' experience I have reached the conclusion that 10 or 12 drops of water are sufficient for the amount of injection fluid. Thus we may have a solution in which $\frac{1}{10}$ of a grain of sublimate is dissolved in 10 drops of water, another of $\frac{1}{8}$ of a grain in the same quantity, and for exceptional instances $\frac{1}{6}$ or $\frac{1}{4}$ of a grain to the same amount. As a rule, it will be found that as an all-around solution the one containing $\frac{1}{8}$ grain to 10 drops will be the most used and the most effective. For a few injections a greater strength may be required by reason of emergency or the severity of symptoms, and in most instances benefit will result. These solutions must be made with great care and with distilled water, and then they should be filtered. Whenever they show signs of turbidity they should be rejected.

White[1] of Guy's Hospital has recently reported his success in the treatment of syphilis of the nervous system with the sublimate injection. He first injects deeply into the gluteal muscles $\frac{1}{8}$ of a grain of muriate of morphine, then, withdrawing and recharging the syringe, he injects $\frac{1}{8}$ of a grain of the mercurial. He speaks of one case in which daily injections for nearly ten weeks were made. In this connection it should be remembered that by such a treatment we are liable to induce a craving for morphine. It is always better for the patient to stand the pain.

Cruyl[2] has modified the use of sublimate hypodermically by using olive oil as the means of suspension. A given quantity of sublimate is dissolved in ether, and then incorporated with the oil. The dose is the same as in watery solutions. No bad effects are produced by these injections.

A further modification of the sublimate treatment is in the form of emulsion with vaseline oil, which Tchistiakoff[3] considers very valuable in severe cases, and not attended with bad results. This same observer has made a number of experiments[4] in order to find a combination with sublimate which does not give rise to pain, and concludes that the following combination answers the purpose well:

[1] "On the Treatment of Syphilis, especially of the nervous system, by the Subcutaneous Injection of Perchloride of Mercury," *Lancet*, June 6, 1891.

[2] "Une Nouvelle Injection mercurielle sous cutanée," *Annales de Dermat. et de Syphilographie*, 1890, p. 35.

[3] *Transactions of the Third General Meeting of Russian Med. Men in St. Petersburgh*, 1889, No. 5, p. 158.

[4] *Voënno-Meditzinsky Jürnal*, No. 28, 1889, p. 456.

℞. Hydrarg. chlorid. corros.,	gr. x;
Aquæ destillat.,	℥j;
Acidi tartarici,	ʒss.—M.

The syringe should be made of India-rubber, and should hold 10 or 12 drops, or if larger should be accurately gauged for those amounts. The needles should be of very fine calibre, of steel, and fully an inch and one-eighth or one-quarter long. The greatest care should be taken to keep the syringe and needles (for it is well to have quite a number) in a state of perfect cleanliness and removed from any chance of dust contamination. When the syringe is charged with the sublimate solution and the needle is affixed, the instrument should be placed in a saucer or tray containing a 5 per cent. carbolic solution. In the operation the utmost asepsis should be aimed at, and the injected part should be carefully washed with soap and water, and after that sopped and wiped with carbolic water (5 per cent.). The skin being pinched up in a fold, the needle is to be pushed gently, slowly, but firmly deep into the subcutaneous connective tissues, and then the fluid is to be expelled slowly and with care, in order that the tissues may not be bruised more than necessary. Slight massage over the injection will aid in its diffusion into the tissues. It must always be borne in mind that the fluid should not be thrown into the deep parts of the derma proper, for the reason that if there deposited it is very prone to produce an eschar, which will result in the destruction of the whole thickness of the skin. Then, again, great care must be exercised that the point of the needle is not lodged in a vein, in which case dizziness, syncope, a feeling of suffocation, pain in the heart and lungs, and other alarming symptoms will be observed. To avoid this accident the surgeon must watch the piston of the syringe while he is injecting. If there is a moderate but mild resistance to the injected fluid, as will be the case if the tip is in the subcutaneous tissues, he may know that he is all right. If, however, the injection seems to pass out of the syringe without any or with very little resistance, there is fear that the tip is in a vein. Under these circumstances it is well to push down farther or withdraw the needle a little until the normal resistance shall be felt and no untoward symptoms threaten. A very moderate amount of practice in the use of hypodermic injections will teach the surgeon to know when he is in danger of doing harm.

Various—indeed almost all—parts of the body have been selected for this method of treatment. The arms and legs have been used and abandoned, for the reason that much discomfort, pain, and muscular inability is generally produced. The back in a line from the shoulders to the hips, at a distance of about six inches on either side of the spinal column, was utilized by Lewin, and may occasionally be used when

other parts fail to offer a proper site for injections. It is always important, when using any form of subcutaneous injection of mercury, to avoid parts liable to be compressed over bony ridges or prominences or where extra pressure of the garments is exerted. After many years' experience I have come to look upon the gluteal regions as the most advantageous sites for mercurial injections. Smirnoff first called attention to the depressions just behind the great trochanters as eligible sites for injections, and I think that no parts of the body lend themselves to our purpose as well as these. Injections made here, as a rule, cause little if any pain and but small and ephemeral nodosities. In this region quite a number of injections may be given, and in most instances sufficient surface is offered for the requisite injection-treatment. We can resort also to the hypogastric regions and to the parts near the inguinal lymphatics, above and below; but whenever the upper parts of the thighs are used great care must be exercised, and the injections tried in a tentative manner in order to determine whether we can continue them or not. As it is very often important to act locally upon lesions of the penis and of the lymphatics arising therefrom, we may have to utilize the tissues in their vicinity. It must always be remembered that injections should not be made into the mons veneris or under the skin of the penis. The region of the neck, particularly its back portions, may be used in some extreme cases requiring local or regional therapy. Care must be exercised that vessels and nerves are not punctured or injured. Whenever mercurial injections are employed for localized deposits or new growths, the anatomical peculiarities of the parts must be taken into consideration.

As a rule, the injection of $\frac{1}{5}$ or $\frac{1}{6}$ of a grain of sublimate every second day will be attended with no bad or annoying results, and even a daily injection may be well borne and may produce good results. No absolute rule can be given as to the dose or its frequency: as has already been said, each case is a problem, and when treated with these injections, as with all methods of antisyphilitic therapy, must be carefully watched. If the general condition of the patient is improved, if his lesions show signs of yielding to treatment, and if the annoyances and discomforts of his disease are ameliorated, the physician may be assured that he is on the right track, and he can increase the dose or the frequency of the injections according to the indications presented. It is astonishing how seldom stomatitis or intestinal troubles are produced even when massive doses of the sublimate are injected.

The unpleasant local effects are as follows: Pain at the point of puncture; pain at the site of the injection; an erythematous condition of the skin, with heat and itching or burning; infiltration in the subcutaneous tissues and localized firm nodosities.

The pain at the point of puncture is usually trifling, and is seldom seen in this era of asepsis.

The pain at the site of the injection may be severe, and even lasting in some few instances, but as a rule it ceases in a few hours. It may last one or more days, and give way to a sensation of tenderness and soreness of varying degrees. In many cases it will be observed that pain is felt after the first few injections, and that thereafter it is not complained of. The temperament of the patient in this ordeal, as in disease in general, has much to do with the presence or absence of pain following injections.

An erythematous halo of greater or less extent may often be observed even when the utmost care has been taken with the injection. As a rule, this hyperæmia is slight and ephemeral, and causes little annoyance. In some cases the redness is deep and the burning and itching are severe. It is a condition readily cured by rest and cooling lotions.

Infiltration into the subcutaneous tissues may be of various grades of severity. In somewhat exceptional cases it presents many of the objective features of erythema nodosum. We may also find more or less extensive induration of a brawny character, which may be painful or the reverse. In some instances prompt involution occurs, and in others the thickened condition is very persistent, so that patients present large surfaces of skin the seat of brawny swelling and thickening. The nodosities are usually the sequelæ of diffuse infiltrations. In some cases each injection gives rise to a localized marginated subcutaneous tumor which presents a feeling of firm structure. These nodosities remain in an indolent condition for a time, and then disappear.

In the sense in which we understand the abscesses which follow calomel injections, it may be said that these complications are not observed in sublimate injections. During more than twenty years I have seen but two, or perhaps three, subcutaneous abscesses. They are certainly of great rarity. I have seen in my own practice and in that of another surgeon a localized gangrene of the skin occur in consequence of the injection not having been thrown into the subcutaneous tissues, but rather into the deep parts of the derma. In these cases the entire skin, for an area corresponding to the extent of the injection, is killed. The process of decay is a rather slow one, and the morbid tissue is thrown off and a clearly punched-out wound is left. With ordinary care this troublesome accident may be avoided.

Sal alembroth, the double chloride of mercury and ammonium, was introduced into the therapeutics of syphilis by Bloxam[1] of London as

[1] "On the Intramuscular Injection of Mercury in Syphilis," *Lancet*, April 28, 1888; and "On Syphilis and its Treatment," *Ibid.*, May 5, 1888.

being preferable to all other mercurial preparations for hypodermic use. The solution found by the author most efficient was one which did not contain an excess of chloride of ammonium, and was made by dissolving 32 grains of sublimate and 16 of chloride of ammonium in sufficient water to make 2 ounces. The dose of this solution, which is not liable to decompose, is 10 minims, and it should be injected deep into the glutei muscles once a week. By this agent the author claims that he has been very successful in the treatment of syphilis, using the injections weekly, bimonthly, and monthly for a period of eighteen or twenty-three months.

Composite Preparations of Mercury.—Early in the history of sublimate injections efforts were made to obtain a salt or a combination which should be so bland as to cause no pain or irritation, and which would be more promptly absorbed and readily assimilated than the bichloride. The search for this panacea began in 1871, and it still continues. To Staub[1] may be given the credit of first proposing a chloro-albuminous solution of mercury. He used the following formula:

℞. Hydrarg. bichlor., gr. xx;
Ammon. chlor., gr. xx;
Sodii chlor., ʒj;
Liquor. ovi albi,
Aquæ destillat., *āā.* fʒiv.—M.
Sig. Inject 20 minims at a dose.

Staub's fluid was not used largely, even in France, where the bichloride solution was preferred. In 1876, Professor Bamberger[2] introduced an albuminous mercuric compound which was largely used, and is even employed at this time. Bamberger's solution is made as follows: To 100 c. c. of a filtered solution of white of egg (containing 40 c. c. of albumin and 60 c. c. of water) there are added 60 c. c. of a solution of mercuric chloride (containing 5 per cent. or 3 grm. Hyd. Cl_2) and 60 c. c. of a solution of sodium chloride (containing 20 per cent.); finally, 80 grm. of distilled water are added, which brings the bulk of the solution up to 300, containing 0.010 sublimate in every cubic centimetre. Upon the hypothesis that in stomach ingestion sublimate is first converted into an albuminate, which in its turn is readily absorbed, Bamberger's fluid was accorded an extensive use in Germany. But by reason of the more or less prompt deteriora-

[1] *Traitement de la Syphilis par les Injections hypodermique de Sublimé à l état de Solution chloro-albumineuse*, Paris, 1872

[2] "Ueber Hypodermatische Anwendung von löslichen Quecksilber-albuminat." *Wiener med. Wochenschrift*, No. 11, 1876; and "Nachträgliche Bermerkung über die darstellung des löslichen Quecksilber-albuminat," *Ibid.*

tion of this fluid (in its becoming turbid and precipitating a white substance consisting chiefly of calomel) it gradually fell into disfavor—a result which was accelerated by the fact that its injection produced nearly if not as much pain as the sublimate injections. I used this solution in many cases over a considerable period of time, and abandoned it by reason of the uncertainty of the dosage from precipitation, and from the fact that it possessed no advantage over the sublimate solution. My colleague, the late Dr. Bumstead, reached a similar conclusion.

With the death of the mercuric albuminate, phœnix-like a new preparation was heralded. For this therapeutic novelty the world is indebted to the late L. Martineau[1] of Paris, who in season and out of season, wrote in journals and in societies spoke words of praise about his *peptone mercurique ammonique*. According to this enthusiastic physician, the syphilitic panacea had at last been found, which was readily absorbed, caused no pain or inconvenience, and cured promptly every case. The formula of the preparation is as follows:

R. Hydrarg. bichlor.,	ʒiiss;
Pepton (Catillon),	ʒss;
Ammon. chlor.,	ʒss.—M.

Fifteen grains of this preparation contain 4 grains of sublimate. It was diluted in water alone and in a mixture of water and glycerin, and was injected in doses of from ½ of a grain upward. Though so much vaunted, the preparation was not largely used, and since the death of its introducer it has passed into the limbo of therapeutical curiosities.

A number of observers have also published papers on peptone-mercury in various forms and modifications in syphilis. Though numerous, these essays contain nothing worth recording, and they themselves may well be speedily forgotten.

Hydrochloric Glutin-Peptone Sublimate.—This newly-elaborated compound has been recently much praised by Hüfler,[2] who contends in favor of soluble preparations of mercury for hypodermic use in syphilis. In Strümpell's clinic sixty patients were treated by this new compound. It is claimed by Hüfler that the remedy is prompt and efficient, that it causes no local reaction, and that relapses are no more frequent than when other treatments are followed. It may be remarked that such polypharmaceutic refinements as the one just mentioned should

[1] "Des Injections sous cutanées de Peptone mercurique Ammonique dans le Traitement de la Syphilis," *Union médicale*, 1881, 3d series, vol. xxxiii., pp. 97, 125, 136, 149, 174, and 186; and "Leçons sur la Thérapeutique de la Syphilis," *La France médicale*, 1882, tome 2, Nos. 17 to 34.

[2] "Ueber die Behandlung der Syphilis mit Salzsauren Glutinpeptone Sublimat (nach Dr. Paal)," *Therap. Monatshefte*, Sept., 1890, p. 437, *et seq.*

be looked upon only as therapeutical curiosities, to be used by those seeking novelty rather than true scientific results. This preparation is said to have been patented by its inventor, Dr. Paal. It is scarcely probable that he will be annoyed with the prosecution of many infringement suits.

Bockhart[1] introduced into medicine a preparation which he calls blood-serum mercury, which he thinks is better than any other combination of mercury and albumin. It is, he claims, of fixed composition, and when injected under the skin causes little if any pain or inconvenience, even when injected into the thighs. It is prepared as follows from the blood of sheep, horses, or oxen: 10½ drachms of blood-serum, sterilized after Koch's method, are placed in a graduated glass, and then mixed with a solution of 45 grains of bichloride of mercury dissolved in 1 ounce of boiling distilled water. The precipitate formed is redissolved by the addition of 105 grains of chloride of sodium dissolved in 5 drachms of distilled water. This compound is then a 3 per cent. solution of blood-serum mercury. By adding enough distilled water to make the whole measure 6 fluid ounces and 5 drachms, we have the solution generally used, containing 1½ per cent. of the mercurial salt. In every detail of preparation the most scrupulous care must be taken to preserve an aseptic condition. Fifteen minims of this solution contain ¼ of a grain of sublimate combined with albumin. Injections should be made daily or every second day. This liquid is of a yellowish opalescent color, and shows little tendency to decomposition if kept in a dark bottle in a cool place.

Bockhart employed this preparation in many cases of early syphilis, of condylomata, gumma of the tongue, gumma of the skin, of syphilitic ozæna, and of scaling syphilitic eruptions of the palm, and found excellent results. Lipp, however, thinks that the remedy is less efficacious and more painful and uncertain in its action than the utterances of Bockhart would lead us to expect. Hallopeau[2] says that the experiments made with this preparation at the Hôpital St. Louis did not realize his expectations. All the patients thus treated complained so bitterly of the pain produced that the remedy was of necessity given up. Rona,[3] on the other hand, though he concedes that the remedy has some drawbacks in the way of local and general reaction, thinks that it is a valuable one and worthy of trial.

Cyanide of Mercury was brought prominently forward by the late Tilbury Fox[4] as a very efficient and satisfactory preparation in the

[1] "Blut-serum-Quecksilber, ein neues präparat zur Injections-behandlung der Syphilis," *Monatshefte für Praktische Dermatologie*, 1885, No. 5, pp. 137, *et seq.*

[2] *Revue des Sciences médicales*, vol. xxvii. 1886, p. 241.

[3] "Blut serum Quecksilber (Bockhart) gegen Lues," *Monatshefte für Prakt. Dermat.*, June, 1886, p. 287, *et seq.*

[4] *Skin Diseases*, London, 1873, pp. 306 and 307.

treatment of syphilis; and it has again recently been advocated as a most excellent antiseptic by Chibret.[1] Fox employed it in the form of pills, with the initial dose of $\frac{1}{20}$ of a grain thrice daily. This agent was first employed by the hypodermic method by Cullingworth,[2] who reached the conclusion that it was superior to the sublimate by reason of the mildness of pain and of local reaction, and of its stability in solution. Therapeutically, he found it very efficient, and employed the following formula:

R. Hydrarg. bicyanidi,	gr. xij;
Glycerini,	f℥ss;
Aquæ destillat.,	q. s. ad f℥iv.—M.

The medium dose was 10 drops ($\frac{1}{18}$ grain), injected every day, but double the quantity can be used in appropriate cases under careful surveillance.

This agent was not extensively adopted as an anti-syphilitic remedy, and little was then heard of it until the year 1876, when Sigmund[3] praised it, and placed it next to sublimate and calomel in its potency. This observer regarded it as beneficial in mild cases, and noticeable for its slight disturbance of the tissues after injections. Sigmund's opinion was endorsed by Mandelbaum[4] of Odessa, who regarded it as a good remedy in public practice for many reasons, particularly its cheapness. It would seem that in Mandelbaum's experience this agent causes pain, for he has since published a formula which contains cocaine, as follows:

R. Cocaini muriat.,	gr. j;
Hydrarg. bicyanidi,	gr. $\frac{1}{6}$;
Aquæ destillat.,	♏ xv.—M.

This quantity is sufficient for one injection.

As showing how one man's experience in the use of a drug is diametrically opposed to that of another, it is interesting to give the views of Güntz[5] of Dresden upon the effects of the cyanide hypodermically

[1] "Étude comparative des pouvoirs Antiseptiques du Cyanure de Mercure, et cet." *Compt. rendus Acad. des Sciences*, Paris, 1888, cvii. 119.

[2] "On the Subcutaneous Injection of Mercury," *Lancet*, vol. i., 1874, May 9, 16, and 23.

[3] *Über Neuere Behandlungsweisen der Syphilis*, Vienna, 1876; and *Vorlesungen Über Neuere Behandlungsweisen der Syphilis*, Vienna, 1880.

[4] "Ueber die Behandlung der Syphilis mit Subcutanen Injectionen von Bicyanuretum Hydrargyri," *Vierteljahr. für Derm. und Syphilis*, 1878, 201, *et seq.*; and "Kokain als Schmerzstillendes Mittel bei der Hypodermatischen Syphilis-Behandlung," *Monatshefte für Prakt. Dermat.*, vol. vi. p. 241, *et seq.*

[5] "Ueber Subkutane Injektionen von Bicyanuretum Hydrargyri bei Syphilitischen Erkrankungen," *Wien. med. Presse*, 1880, xxi. pp. 563, 598.

used. This observer says that the solution is very unstable and should be used up quickly, and that its use causes much pain, vertigo, noises in the ears, nausea, and syncope. It is very probable that he selected for his injections places which are particularly sensitive, and that when he observed syncope, etc., these alarming symptoms were due to the fluid being injected directly into a vein. Güntz convinced himself of the very rapid action of the remedy, and that by its hypodermic use salivation might be induced. The infiltration of the skin was less than after the employment of the bichloride.

Cyanide of mercury was first used in syphilitic eye affections by Galezowski,[1] who injected from 5 to 10, and even 15, milligrammes in men. The author reports cures in seven cases of iritis with interstitial infiltration into the cornea, iritis and condylomata, iritis and keratitis punctata, irido-choroiditis, interstitial keratitis, and neuro-retinitis. Isolated cases in support of Galezowski's claims have appeared from time to time in medical journals.

It is needless to mention a number of papers published within the last ten years upon the therapeutic effects of this drug, since they all, in the main, endorse what has already been said. The most important recent paper is by Boer[2] of Berlin, who used the cyanide upon thirty cases of syphilis in men and women, and who thinks that it has an antibacterial action. Besides its promptness of action and mild local irritating effect, Boer thinks the cyanide beneficial for the following reasons: 1, it does not coagulate albumen, and has a neutral or alkaline reaction; 2, it is less irritating than sublimate; 3, and does not become decomposed by light.

Iodo-Tannate of Mercury was prepared by Nourry[3] with the idea of obtaining a preparation to which the stomach is not intolerant. Dujardin-Beaumetz, who tried this salt in practice, thinks that it fulfils the hopes of its inventor. It is used hypodermically in the following solution:

℞. Hydrargyri,	gr. $\frac{1}{8}$;
Iodini,	gr. $\frac{1}{2}$;
Acid. tannic.,	gr. $\frac{3}{5}$;
Glycerini,	ℳ xv.—M.

This quantity is said to be rather too large, and liable to produce salivation, therefore but half of it should be used.

[1] "Des Injections hypodermiques du Cyanure de Mercure dans la Syphilis oculaire," *Progrès médical*, April 15, 1862, p. 279, *et seq.*

[2] "Injectionen von Quecksilber Oxycyanid gegen Syphilis," *Therapeut. Monatshefte*, 1890, p. 332, *et seq.*

[3] "Sur les Injections hypodermiques à l'Iodo-tannate d'Hydrarg. soluble," *Bull. gén. de Thérapeutique*, 1888, p. 364, *et seq.*

Its action is said to be very rapid, and the injection is attended with neither pain, nodosities, nor abscesses.

Bichloride of Mercury and Potassium.—This compound was first used hypodermically by Aimé Martin,[1] who used the following formula:

℞. Hydrarg. biniodidi, Potassii iodidi, āā. gr. vj;
Aquæ destillat., ʒj.—M.

Of this solution as much as half a drachm was injected at a dose. Martin described a severe case of generalized syphilides, which had been treated in vain for two years, which was cured by two of these injections. In the second case syphilis had existed for six months and was rebellious to mercury by the mouth. The usual dermal, mucous, and glandular lesions were promptly caused to disappear by one injection.

Bricheteau[2] considered that the iodide of potassium is irritant to the tissues, and after many experiments adopted a formula containing the double iodide of mercury and sodium, which he thought free from that objectionable quality. His formula was as follows:

℞. Hydrarg. et sodii iodidi, gr. xxiij;
Aquæ dest., ʒiij.—M.

The dose by hypodermic injection is 10 drops, which may be increased to 20. The author advises the use of this formula in cases where rapidity of action is necessary, as in iritis and severe cases of syphilis.

The So-considered Antiseptic Group.

Salicylate of Mercury.—Introduced into pharmacy by Lajoux and Grandval in 1881, salicylate of mercury was first recommended as an antisyphilitic remedy by Silva Aranjo[3] in 1887, and since that date it has been used by a number of observers, who claim for it exceptional merit. It is used in pill form, and in suspension it is injected into the muscles.

It is claimed for this new remedy that it is more promptly

[1] "Sur l'Emploi des Injections hypodermiques d'Iodure de Mercure et de Potassium, dans le Traitement de certains accidents de la Syphilis secondaire et tertiaire," *Gazette des Hôpitaux*, Sept. 12, 1868.

[2] "On the Application of the Hypodermic Method to the Treatment of Syphilis by Mercury," *Practitioner*, vol. ii., 1869, p. 141, *et seq.*; and *Bull. gén. de Thérapeutique*, vol. lxvii., 1869, p. 297, *et seq.*

[3] "Du Traitement de la Syphilis par le Salicylate de Mercure," *Bull. gén. de Thérapeut.*, Paris, 1888, cxiv., p. 175, *et seq.*; and "El Salicilato de Mercurio y sus Applicaciones en la Sifilis y en algunas Dermatitis," *Revista de Medicina y Farmacia*, 1887, ii. 2, pp. 12–14.

absorbed than any other mercurial preparation; that it is well borne by the stomach, does not produce gastro-intestinal disturbances or diarrhœa; and that it rarely if ever causes stomatitis. Used by stomach ingestion, salicylate of mercury may be given in pill form in doses of from $\frac{1}{4}$ to $\frac{3}{5}$ of a grain three times daily. If very prompt action is desired, the large dose of 1 grain three times daily may be administered, but Szadek says that if pushed too vigorously the remedy may cause intolerance on the part of the stomach. In doses of 2 grains daily it has been used with benefit for periods of from two to three months, without any cause for interruption. It is claimed to be of especial benefit in the early secondary period, of the lesions and symptoms of which it causes involution and disappearance. In relapsing secondary lesions of the skin and mucous membranes it also proves very effective. In late tertiary forms of syphilis, particularly those affecting the skin, it is also claimed to act promptly and efficiently.

Salicylate of mercury has been used in the form of subcutaneous and intramuscular injection by a number of observers, notably by Szadek.[1] The latter uses the following solution:

℞.	Hydrarg. salicylat.,	gr. xvj–xxiv;
	Mucil. acaciæ,	gr. viij;
	Aquæ destillat.,	f℥vss.—M.

The dose of this liquid is the contents of a Pravaz syringe, which may be administered into the gluteal region beneath the muscular fasciæ every third day. The number of injections used in various cases was from four to twelve. Epstein employed this salt in oil emulsion, and Hahn in suspension with vaseline oil. When used in the form of an injection it is claimed that little harm is produced, that the local reactions are much less severe than by the use of other mercurial salts, and that the resulting nodule gives little inconvenience and is soon absorbed. Jadassohn and Zeissig, Welander Peterson, Tschistiakoff, and others speak in praise of this mercurial salt.

It is interesting to note that Touton[2] reports the case of a man in whom zoster femoralis followed the third injection of salicylate of mercury. Touton is of the opinion that this skin lesion was of reflex origin, and due to trauma of a nerve. This may be considered a very unusual complication of hypodermic medication in syphilis.

Carbolate or Phenate of Mercury was introduced into the therapeutics

[1] "Ueber behandlung der Syphilis mit Intra-musculären Injectionen von Quecksilbersalicylat," *Wien. klin. Wochenschrift*, No. 13, 1890.

[2] "Zoster femoralis im Auschluss an eine intra-musculäre Salicylquecksilber Injection," *Archiv für Derm. und Syph.*, 1889, p. 775, *et seq.*

of syphilis by Gamberini,[1] who regards it both as an effective form of mercury and as being valuable by reason of the supposed antimicrobic action of the carbolic acid. This salt belongs to the group of mercurial compounds which have been prepared and exploited as possessing a distinct antimicrobic effect—a group which is composed of the thymolate, the benzoate, and the salicylate. It is well known that we are wholly lacking in positive knowledge of any micro-organism of syphilis; consequently the claim that an agent possesses a specific parasiticidal effect on the disease is based on pure assumption. This particular preparation is claimed to be as potent as any other mercurial preparation. Carbolate of mercury may be given in pill form, each pill containing one-sixth of a grain of the salt covered with gelatin or balsam tolu. The dose at first is two pills daily, which may be increased to six pills. In some cases six pills produced mild gastro-enteritis, and in one case the remedy was abandoned on account of intestinal colic. In two cases of papular syphilides $\frac{1}{6}$ of a grain of this salt, dissolved in 15 drops of water, was injected during a period of two months without good results. In the hospital at Würzburg this preparation was tried by Happel.[2] He injected about one-third of a grain every day or two, using on an average fifteen injections. He saw no abscesses and very slight nodules. In a few women malaise, headache, and chills were produced.

This new remedy was (as might be supposed) tried by Szadek,[3] who was well pleased with its action in pill form in mild cases and in relapses, administered to adults and young infants. By hypodermic injection into the subcutaneous tissues and the muscles he also used it with gratifying results. He found that it was readily absorbed, and that the injections caused little local and rarely any general disturbance.

Lexer[4] made comparative studies of the effects of injections of various mercurial preparations, and arrived at the following results: That relapses occurred after inunctions in 9 per cent.; after sublimate, in 13; after the salicylate of mercury, in 15; after formamide, in 16; after the peptonate, in 16; after the gray oil, in 16; after the tannate, in 18; and after the carbolate, in 27 per cent. By this showing the carbolate of mercury is among the least efficient of mercurial preparations.

[1] "Il Fenato di Mercurio, nuova medicamento per la cura della Sifilide," *Giornale della Malat. Veneree e delle Pelle*, 1886, p. 241.

[2] "Die Behandlung der Syphilis mit Subcutanen Injectionen von Hydrargyrum Oxydatum Carbolicum," *Inaug. Dissert.*, Würzburg, 1888.

[3] "Innerliche Anwendung des Hydrargyri Carbolici Oxydati bei Syphilis," *Monatshefte für Dermat.*, 1887, p. 195, *et seq.*, and "Ueber hypodermatische Anwendung von Hyd. carbol. oxydat. bei Syphilis," *Ibid.*, 343.

[4] "Beitrag zur Beurtheilung der Werthes der Verschiedenen Quecksilber präparate in der Syphilis-therapie," *Archiv für Derm. und Syphilis*, 1889, p. 715, *et seq.*

De Luca[1] also experimented with this salt, of which he administered pills containing about $\frac{1}{3}$ of a grain three to six times a day. The results were no better than those of other mercurial preparations, and were comparable to those of the tannate of mercury. Diarrhœa and intestinal pains were noted in some cases.

It must be remembered that the carbolate, the bicarbolate, or diphenate of mercury, above considered, must not be confounded with diphenyl mercury, which is a deadly poison.

Szadek[2] also used the carbolate of mercury by injections into the subcutaneous tissue and muscles in the form of a 2 per cent. solution in water and gum arabic. He states that no pains were produced, but sometimes the muscles became stiff after the injections. Complications are very rare, and the action of the drug is rapid. Ten injections are usually necessary. Troitzki, who took part with Szadek in these experiments, entertains the latter's views as to the efficacy of the mercurial agent.

A survey of the results thus far experienced in the use of this remedy convinces me that it has no striking qualities, and that it is not to be preferred to the classic preparations.

Thymolate of Mercury (hydrargyrum thymolo-aceticum, Merck) is an insoluble salt which was first used in the treatment of syphilis in Neisser's clinic, the details of which are given by his assistants, Jadassohn[3] and Zeissig. These observers used a 10 per cent. suspension of the drug in fluid paraffine, and injected for a dose from $\frac{1}{3}$ of a grain to 1 grain into the muscular tissues. They think they have seen in its action results not attainable with any other mercurial salt, without the usual drawbacks of pain, infiltration, and abscesses. Thymolate of mercury, used hypodermically, exerts a rapid and energetic action upon syphilitic manifestations, less pronounced than that of calomel, but greater than that of gray oil. Six or eight injections are sufficient for a cure. Wellander[4] of Stockholm, having tried the remedy in forty-four cases, endorses the encomiums of Jadassohn and Zeissig, though he states that it does not attain the ideal of perfection in syphilitic therapy. He used larger doses of the drug than his predecessors, going as high as a grain and a half, and injecting into the subcutaneous tissues as well as into the muscles. In his experience the local inflammatory phenomena were greater than those observed in

[1] *La Riforma Med.*, 1888.

[2] "Du Traitement de la Syphilis par les injections profonds et sous-cutanées de Phenate de Mercure," *Meditzin. Obozrenië*, No. 6, 1887; and *Bull. gén. de Thérapeutique*, 1887.

[3] "Einspritzungen von Salicyl- und Thymol-Quecksilber zur Syphilis Behandlung," *Vierteljahr. für Derm. und Syphilis*, 1888, p. 781, *et seq.*

[4] "Ueber die Behandlung der Syphilis mit Injectionen von Thymol- und Salicyl-Quecksilber," *Ibid.*, 1889, p. 453, *et seq.*

Neisser's clinic. Szadek,[1] who seems to be always on the alert for new antisyphilitic remedies, has published his results with thymolate of mercury. This experimenter uses the following formula:

℞. Hydrarg. thymolo-acetic.,	gr. xxiiss;
Mucil. acaciæ,	gr. viiss;
Aq. destillat.,	ʒv.—M.

Of this liquid the contents of a Pravaz syringe was injected into the thighs every three or four days. The maximum number of injections was eight or ten, and the duration of treatment averaged twenty-seven days. The local reaction was mild, there were no indurations, no nodosities, and never was an abscess produced. These results induced Löwenthal[2] of Senator's clinic to use the drug suspended in glycerin and combined with muriate of cocaine. Improvement was noted after one or more injections; no abscesses occurred in the course of two hundred and ninety-three injections. Salivation was only observed in one patient, having bad teeth, and in another nausea and rigors were produced. Löwenthal thinks that the drug has a future as an antisyphilitic remedy.

Cehak[3] also has used thymolate of mercury on a large scale with excellent results. He injected a 5 and a 10 per cent. emulsion in paraffin oil into the buttocks every second or fourth day. No unpleasant sequelæ were observed.

Benzoate of Mercury.—This preparation was introduced into medicine by Professor Stukobenkoff,[4] is known as hydrargyrum benzoicum oxydatum, and contains 43 per cent. of mercury. It is slightly soluble in cold water, and readily so in alcohol or a weak solution of chloride of sodium. Stukobenkoff has used it extensively in syphilis, employing a solution containing 4 grains of the mercurial, 2 grains of salt, 1 grain of muriate of cocaine, in 1 ounce of water. Of this mixture a Pravaz syringeful is injected daily into the buttock muscles. It may also be used as a 10 per cent. solution in liquid vaseline. This drug is said to act very rapidly upon early and late secondary lesions. A sensation of slight burning, which lasted two or three days, was observed, as well as mild gingivitis and salivation. It may also be administered in pill form (gr. $\frac{1}{3}$ to $\frac{3}{4}$), but the recorded results of its

[1] "Zur Behandlung der Syphilis mit intra-musculären Injectionen von Hydrargyrum Thymolo-aceticum," *Wiener med. Wochenschrift*, 1890, No. 22.

[2] "Intramusculäre Einspritzungen von Hydrargyrum Thymolo-aceticum bei Syphilis," *Deutsche med. Wochenschrift*, 1890, xvi. p. 544.

[3] "Ueber Thymolquecksilber-injectionen," *Allg. Wien. med. Zeitung*, 1890, No. 7.

[4] "Ein Neues Hg-Salz-Hydrarg. benzoicum oxydatum zur Behandlung der Syphilis," *Vratch*, No. 4, 1889, p. 93; and *Vierteljahr. für Derm. und Syphilis*, 1889, vol. xxi. p. 439.

action are not striking. Its sponsor also used it in its purity, and in liquid form as an application for chancroids, and for gonorrhœa and gonorrhœal cystitis as an injection.

Stukobenkoff's preparation has been used at the Lourcine Hospital in Paris by Balzer and Thiroloix, and their results are given in the thesis of Cochery.[1] The formula already given was used by the French observers, who found that it was a very unstable compound, in that in fifteen days two-fifths of the mercury was lost by decomposition and precipitation. The objection which applies to all soluble salts of mercury, that the dose needs daily repetition, is urged against this salt. Its sole advantage, according to these experimenters, is the mildness of the pain following the injections. Their conclusion is terse and to the point: "*En resumé, une nouvelle formule d'injection à ajouter aux autres mais un progrès bien minime s'il existe même.*"

The Amide Group.

Formamide of Mercury.—Formamide of mercury, hydrargyrum formamidatum, was introduced as an antisyphilitic remedy by Liebreich.[2] This observer, impressed with the view that the amides of the body—of which urea may be taken as the principal one—pass out of the system in an undecomposed state, concluded that if combined with mercury decomposition would occur, and that the latter would be reduced and deposited in the tissues; in other words, that this amide would serve as a vehicle for the diffusion of the mercurial. Liebreich is said to have demonstrated this fact before the Medical Society of Berlin. He employed a 1 per cent. solution, and administered one or more Pravaz syringefuls daily into the subcutaneous tissues. The formamide is readily soluble in water, of neutral reaction, and does not coagulate albumin. The action of the drug is rapid and effective. Injected under the skin, it is easily borne, attended with little pain, and not liable to produce salivation. It is said by Liebreich to be much less irritating and painful than the sublimate. Relapses after this treatment are said to be rare, and mild in character. Kopp[3] in Neisser's clinic treated one hundred and twenty-six cases by Liebreich's method, which he submitted to what seems to have been a careful and impartial trial. He used from twenty-five to forty injections into the buttocks in early and late syphilis. He observed salivation and stomatitis in twelve cases (four men, eight women), abscess-forma-

[1] *Traitement de la Syphilis par les Injections sous-cutanées de Benzoate de Mercure*, Paris, 1890.

[2] "Ueber die Behandlung der Syphilis mit Quecksilberformamid," *Wien. med. Presse*, 1883, xxiv. pp. 17–20.

[3] "Ueber die Behandlung der Syphilis mit Subcutanen Injectionen von Hydrargyrum formamidatum (Liebreich)," *Vierteljahr. für Derm. und Syphilis*, 1885, Heft. 1 and 2, p. 55. *et seq.*, and 184, *et seq.*

tion in one woman, pain of a mild and ephemeral character in thirty-four cases, and in a more lasting and pronounced form in thirty-one cases. Subcutaneous nodules and inflammatory infiltration occurred forty-one times. Kopp concludes from the treatment of mild cases that relapses are frequent, and that it is less energetic than inunctions. The formamide solution keeps better that that of mercurial peptones, but not as well as a solution of the cyanide of mercury. Zeissl[1] the Younger used the formamide in fifteen cases. He found the pain less than that of sublimate, and that no inflammatory reaction was induced. On the arm or forearm he saw in one case a little redness and swelling, which disappeared in two or three days. The lesions in the immediate vicinity of the injected spots did not disappear more rapidly than those more remotely situated. In several cases limited portions of the skin became gangrenous. Stomatitis was also observed. In rebellious cases Zeissl used a greater number of injections, of which twenty was the average for a cure. Roma[2] used the formamide upon fourteen cases, of which only five kept up the treatment to the end, three refusing treatment after the first injection, five after the third, and one after the ninth, on account of the severity of the pain. The therapeutical effect of the drug was highly unsatisfactory, and in one of the five cases mentioned as having kept up the treatment a relapse occurred very promptly. The most recent observer who has experimented with Liebreich's compound is Vyshogrod,[3] who treated with it two hundred and twelve patients, Russian soldiers. This author speaks of the rapid disappearance of secondary syphilitic lesions, of the rarity of abscess indurations and of relapses, and of the absence of mouth affections. Added to its activity, its painlessness, and freedom from disagreeable complications, the author thinks the remedy has the further advantage of being cleanly and cheap. In remarks upon Vyshogrod's paper Lünkevitch of Tiflis spoke of the formamide as one of his favorite remedies, and Korona of the same place endorsed it as effective and comparatively painless, and without abscesses when given in the buttocks, but followed by abscesses if given in the back. On the other hand, Gay of Kazan says that the formamide is the most painful of all mercurials, while the bicyanide is the least painful. The latter thinks that all mercurials cause the least pain when they are injected into the buttocks, and the most intense when introduced into the scapular and lumbar regions.

[1] "Zur Behandlung der Syphilis mit Quecksilberformamid," *Wien. med. Presse*, Nos. 5 and 6, vol. xxiv., 1883.

[2] Syphilis gyógyi-ása formiamidum hydrargyratum (higany-formiamid) oldátaval, *Orvosi hetil*, Budapest, 1883, xxvii. pp. 294–298.

[3] *Proceedings of the Caucasian Medical Society*, May 14, 1889, p. 39; and *British Journal of Dermatology*, vol. i. pp. 381, *et seq.*

Some years ago I used this compound hypodermically in several selected cases, and by reason of its comparative slowness of action and of the severe pains induced I soon abandoned it.

Glycocoll of Mercury.—Wolff[1] of Strasburg claims that combinations of (1) glycocoll, (2) of alanin, and (3) of asparagin with mercury are much to be preferred to the formamide of Liebreich, as being more prompt in their action. Given in large doses, these salts produced active salivation and severe effects upon the gastro-intestinal canal. They cause only slight local reaction, and after the injection of 0.01, mercury is found in from six to twenty-four hours in the urine. Wolff thinks that if the reaction at the point of injection is slight, the mercurial preparation acts more quickly, for the reason, he claims, that albuminate of mercury is not formed and absorption of such a deposit is not necessary; in other words, that the remedy is taken up without having undergone chemical metamorphosis.

The durability of the three preparations of Wolff varies. Asparagin-mercury is very unstable; alanin-mercury keeps better; and glycocoll-mercury is a stable product. It is prepared as follows:

℞. Hydrarg. oxid.,	gr. iss;
Glycocoll.,	gr. iv.

Dissolve the glycocoll in 77 minims of water, then add the mercury. When mixed, add water enough to make 2½ drachms, and filter. This is the solution for general use. Or it may be made as follows by keeping on hand these solutions:[2]

1. A solution of carbonate of sodium 1.50 to water 100.
2. Sublimate 3.75 in water 100.
3. Glycocoll 2.50 in water 100.

These must be kept in stoppered bottles. A mixture of equal parts of each of these solutions forms the injection fluid. The dose is a Pravaz syringeful, which contains 1 centigramme of oxide of mercury. The needle of the syringe must be of platinum. The injections, according to Wolff, are best made in the back, after the method of Lewin (see Sublimate Injections). One injection should be made every day or every second day. Secondary manifestations are promptly effaced by this treatment, but it is evident, from Wolff's remarks, that a sharp lookout must be kept, lest untoward symptoms supervene. Wolff thinks that the prompt elimination of mercury in this form is very advantageous.

[1] "Ueber die Subcutane Anwendung des Glycocoll-Asparagin und Alanin-Quecksilbers und deren Wirkung auf den Syphilitische Process," *Monatshefte für Praktische Dermatologie*, vol. iii., 1884, p. 152.

[2] *Annales de Derm. et de Syphilograph.*, vol. v., 1884, p. 645.

Alaninate of Mercury.—This preparation, hydrargyrum alaninicum, was first brought forward as an anti-syphilitic agent by De Luca,[1] who claims that it is exceptionally well tolerated by stomach ingestion and by hypodermic injection. In the latter form, it is, he claims, preferable to all other mercurial preparations, by reason of the smallness of the dose required and the mildness of the local reactions. In infantile syphilis it is to be preferred to other forms of mercury when given by the mouth. In whatever manner given, its effects are gratifying and particularly lasting. It may prove of benefit in cases of late syphilitic manifestations. Selenew,[2] to test De. Luca's statement, employed this treatment in twenty-three cases, using a 1 per cent. watery solution, and injecting $\frac{1}{5}$ of a grain of the salt into the buttocks once daily. The number of injections required varied between twenty-four and fifty-four, and the average sojourn in the hospital was fifty days. Selenew concludes as follows: Alaninate of mercury does not offer any advantages over other soluble preparations of mercury now in use, either as regards the intensity of its general action or its local effects or complications. 2. In the course of its therapeutic use fresh eruptions appear frequently; which fact, therefore, indicates a feeble antisyphilitic power of the drug. 3. In about 40 per cent. of cases the injections give rise to local pain of mild character and to circumscribed infiltration. 4. In about 50 per cent. of cases the remedy induces gingivitis and stomatitis, and in some few a mild and ephemeral diarrhœa. 5. Elimination of mercury in the urine begins on the first day of treatment, and increases between the twentieth and thirtieth injections, and undergoes oscillations during subsequent days; and in this presents nothing unusual. 6. The preparation is very stable, and in a dark bottle will remain unchanged for many days; and in this respect it is superior to the bicyanide and formamidate of mercury.

Succinimide of Mercury was discovered by Dessaignes in 1852, and was introduced as an antisyphilitic remedy by Vollert[3] in 1888, under the auspices of Professor Wolff of Strasburg. It is soluble in water, does not become cloudy, and does not precipitate albumin or hydrocele or pleuritic effusions. It causes little infiltration, and never abscesses, if carefully used. Wolff introduces the syringe obliquely, and endeavors in this way to distribute the liquid in the cellular tissue. He further aids diffusion by gentle massage. The dose is about one-tenth of a grain and upward, dissolved in water and injected into the buttocks. The usual advantages are claimed for this agent.

[1] "L'Alinina Mercurica (alaninato di Mercurio) nella terapia della sifilide," *Riforma Medica*, March, 1888.

[2] "Das Quecksilberalanilat bei Syphilis," *Meditzin Obozren.*, No. xvii., p. 445, *et seq.*

[3] "Ueber Succinimid-Quecksilber ein neues mittel zur Subcutanen Injectionen," *Therapeut. Monatshefte*, Sept., 1888, p. 401, *et seq.*

Selenew[1] has also used the succinimide in the form of a 1 per cent. solution upon thirty-three patients, requiring nine hundred and thirty-three injections. His conclusions are as follows: Syphilitic manifestations disappeared after twenty-four to forty injections. After or during the first five injections roseola and papules often increased in extent and intensity. The initial sclerosis and the ganglia were but little affected. Gingivitis was observed in six cases. Pain and infiltration were almost always absent. Relapses observed during seven months occurred in 8½ per cent., against yellow oxide 8, alanilate 20, salicylate 37, and gray oil 30 per cent. Mercury is found in the urine within the first few days. It is therefore a mild preparation, suitable for mild cases in women and children. In general its action is not very energetic.

Urea-Mercury.—Schütz,[2] in Doutrelepont's clinic, has used a combination of urea with mercury in the treatment of syphilis. He thinks that mercurial preparations formed with the amides are the most efficient, and that urea, the amide of carbonic acid, is preferable to Liebreich's formamide and Wolff's amide. Schütz used the following prescription:

℞.	Hydrarg. chlor. corros.,	gr. xv;
	Aquæ destillat.,	f℥iij;
	Urea,	gr. iiiss–viiss.—M.

Of this solution the dose is a Pravaz syringeful once daily.

This preparation is readily absorbed, and is very promptly found in the urine. It is said to cause little local reaction of any kind, and to produce the rapid disappearance of syphilitic lesions. It has the advantage also of being cheap, hence it can be used in charitable practice. The length of treatment was from thirty-three to eighty-seven days, or an average of seven and a half weeks.

Iodoform.—This agent was first used subcutaneously in syphilis by Bozzi[3] in a case of severe nocturnal osteocopic pains, together with periodic chills and fever, for all of which quinine in large doses had been given without benefit. Two injections of iodoform, each containing 1¾ grains suspended in glycerin, were given at an interval of nine days. There was marked benefit after the first injection, and two days after the second there was entire subsidence of the pains. Abscesses followed each injection. This treatment was then forgotten for many years.

[1] "Zur Syphilis-Behandlung mit Subcutanem Injektionen von Hydrargyrum Succinimidicum," *St. Petersburgh med. Wochenschrift*, No. 36, 1890; and *Monatshefte für Prak. Dermat.*, vol. ii., 1890, p. 406.

[2] "Ueber Quecksilberchloridharnstoff: ein neues Antisyphiliticum," *Deutsche med. Wochenschrift*, 1885, p. 215, *et seq.*

[3] "Dolori Osteocopici Sifilitici curati colla Injeztione Sottocutanea di Iodoformio," *Giornale Italiano della Malattie Vener. e della Pelle*, vol. i., 1871, pp. 49 and 50.

In 1882, Thomann[1] published a short paper, in which he detailed good results from the injection of iodoform in early syphilis and in cases of the initial sclerosis and of ganglionic enlargement. He began with doses of 0.30 (grs. $4\frac{1}{2}$), and increased them to 0.75 (grs. $10\frac{3}{4}$). The drug was suspended in glycerin and almond oil, the latter combination seeming to cause more cutaneous hyperæmia than the glycerin mixture. The effects were said to be good, the pain on injection slight, and the after-effects very mild.

Neumann[2] also tried this agent hypodermically, and found that while it caused the disappearance of early syphilitic manifestations, its action was very slow, and that inflammatory reaction was produced.

Mraček[3] reported a case of early syphilis in which in thirteen days 6 grammes of iodoform suspended in glycerin were injected. The therapeutic result was not striking. Iodine was promptly found in the urine, and only disappeared therefrom after the lapse of forty days.

In a later communication Thomann[4] concludes that this agent is useful in the second stage in producing resolution of swollen ganglia, particularly when the injections are made in close proximity to them. It is, however, most beneficial in tertiary syphilis, when 0.50 to 1.50 are used at a dose. Thomann says that in his later observations he used as much iodoform in thirteen injections as he had at an earlier date in sixty-five injections, and that he produced no bad results. He concludes—

1. That in tertiary syphilis iodoform exerts a favorable influence upon the healing process.

2. That large doses shorten the length of treatment.

3. That a long time after the discontinuance of the iodoform injections (as long as forty-three days) iodine is found in the urine. It also appears that the remedy has a lasting effect upon the system.

4. That no bad effects are to be observed, such as acne, iodine-catarrh, etc.

It must always be remembered that iodoform, whether applied to wounds of any kind or administered by the stomach or hypodermically, is a very uncertain remedy, and liable, even in moderately small doses, to produce toxic effects of varying gravity. Consequently, if the physician sees fit to give it a trial he should watch its effects very carefully, particularly as to the cerebro-spinal system. In this connection it is

[1] "Ueber Subcutane Iodoform Einspritzungen bei Syphilis," *Centralblatt für die Med. Wissensch.*, No. 11, 1881; and *Ibid.*, No. 35, 1882.

[2] "Ueber Hypodermatische Behandlung der Syphilis mit Iodoform," *Anzeiger der Gesel. d. Aertze*, No. 27, Vienna, 1882.

[3] *Ibid.* "Ueber Hypodermatische Behandlung der Syphilis mit Iodoform."

[4] "Ueber Behandlung der Tertiären Syphilis Mittels Iodoform Einspritzung," *Centralblatt für die Med. Wissenschaften*, No. 20, 1882.

interesting to note that Jennings[1] observed purpura in a man who had been taking the drug by the stomach in one-grain doses three times a day for six weeks. Upon its discontinuance the eruption ceased. The mental symptoms produced by the drug are stupor and obtuseness, delirium, and even mania.

Iodide of Potassium.—This agent was first used hypodermically by Eulenberg and Thierfelder, but as a method of treatment it has not been largely adopted. In 1882, Besnier[2] reported a case of intolerance of this drug, in which 7½ grains, taken by the mouth, produced extreme pruriginous disturbance, and in which he injected the same dose into the centre of a gummatous syphilide without producing the same phenomena. He then remarks that this new therapeutical procedure should be made the subject of experiment, in order to determine its practical worth. In a later[3] communication Besnier states that he has further used this treatment, and still thinks well of it.

Gilles de la Tourette[4] in five cases injected 7½ grains of the iodide without any marked local complications. He advises that the solution shall be neutral, that the injections should be made deeply into parts rich in cellular tissue, and that the punctures should be made quite far apart. Slight massage over the site of injections is beneficial in relieving the disagreeable itching produced by the injections. Hypodermically used, the author thinks that cases of iodide idiosyncrasy and intolerance may be overcome. The drug acts very rapidly when used in this manner.

Jackubowitz[5] recommends parenchymatous injections for syphilitic adenitis and inflammed ganglia due to any cause. He uses a solution of iodide of potassium 15 grains, tincture of iodine 5 drops, in 1 ounce of water. By means of a hypodermic needle this is thrown into the substance of the glands. The needle is thrust obliquely into the most prominent part of the swelling, and a fourth part of the contents of the syringe is slowly thrown in. In four such manœuvres the syringe is emptied. Several such operations are often necessary for a cure. The pain is stated to be mild, though slight uneasiness is felt, owing to the distension of the tissues. In those cases, not uncommon, in which the glands are very much swollen, as well as in some cases of subacute adenitis of simple origin, this method may be employed.

[1] *Journal of Cutaneous and Genito-urinary Diseases*, 1888, p. 175.

[2] "Un cas d'Eruption bulleuse due à l'Iodure de Potassium," *Annales de Derm. et de Syphilographie*, 1882, p. 169.

[3] "Sur les Injections sous-cutanées d'Iodure de Potassium," *Progrès médical*, Jan. 13, 1883.

[4] "Note sur les Injections sous-cutanées d'Iodure de Potassium, Société de Biologie, Jan. 3, 1883," *Annales de Derm. et de Syph.*, 1883, p. 610.

[5] "Zur methode bei Parenchymatösen Injectionen, eine neue Behandlung der Syphitilischen Bubonen," *Wiener med. Presse*, Nos. 3 and 4, 1875.

In this connection it may be well to mention some late observations by Köbner,[1] though the injections were made into the rectum rather than into the cellular tissue. Köbner presented to the Dermatological Society of Berlin, two years after cure, the case of a woman fifty-six years old who had had syphilitic myositis of the whole left sterno-cleido-mastoid muscle, of eleven years' standing. She had also the same lesion of the lower third of the right sterno-cleido-mastoid, as well as gummy infiltrations into other muscles and into various bones. The iodide, given by the stomach, acted badly, and the woman refused to take it. Inunctions of mercurial ointment and injections of about 12 grains of the iodide into the rectum produced a complete cure in about nine weeks. Köbner thus uses the iodide in all cases of old syphilis in which it produces gastric or general disturbances when given by the stomach. In cases of cerebral syphilis in which there is difficulty of deglutition, and in syphilitic coma, large quantities of the drug may be thus introduced into the system. Professor Rabow in the treatment of mental diseases found Köbner's method of using the iodide and bromide of potassium more satisfactory and rapid than any other. Köbner also claims that he has caused more or less absorption of hypertrophied prostates by means of the rectal injection of the iodide and bromide of potassium combined with belladonna. In order to determine the fact of the absorption of the iodide, Köbner advises that the distal half of the tongue, on its upper or lower surface, or the inside of the cheeks, shall be lightly painted with a solution of nitrate of silver. The solution at once turns yellow if the saliva contains iodine from the formation of iodide of silver.

Thermal Baths; Hot-water and Hot-air Baths; Sublimate Lotions and Baths, and Electro-mercurial Baths.

The Hot Springs of Arkansas and the Treatment of Syphilis.—From time out of mind the waters of mineral springs have been regarded by the laity as curative, and even specific, in the treatment of syphilis and skin diseases especially, and in certain visceral and arthritic diseases. There has been, and perhaps always will be, a deep-rooted belief that waters made in the laboratory of Nature possess an occult and potent effect far in advance of any production of the chemistry of man. Among the many and varied mineral and thermal springs of this country, those of the Hot Springs of Arkansas have undoubtedly taken the most prominent rank, and among the laity, and even among the profession, there is a widespread belief in their efficacy in syphilitic affections, skin diseases, and those of a rheumatic nature. For many years I have had exceptional opportunities for studying the effects of the waters of the Hot Springs, and the treatment pursued there upon

[1] "Ueber die Anwendung von Iod- und Brom-präparaten per Rectum zu localen (regionären) und Allgemeinen Heilzwecken," *Therapeutische Monatshefte* 1889, No. 10.

patients who have been under my care and were temporarily sent there for benefit, upon patients who had been under other physicians prior to their sojourn at the Hot Springs, and upon others whose treatment had been begun there. From this large number of cases I hope to be able to present a fair estimate of the value of these springs as a therapeutic resource in the treatment of syphilis.

An analysis of the water of the most prominent springs in the Arkansas Valley shows that their chief ingredient is silicic acid, and that it, with iron, alumina, lime, magnesia, potash, soda, and traces of iodides and bromides, exists in the proportion of $8\frac{1}{2}$ grains to the gallon of water. It is very evident that no startling effect can be produced by this natural solution, yet some of the advocates of the springs speak in quite positive terms of the specificity of the waters, whatever that may mean. Others claim that the beneficial effect of the waters is due to the electricity, produced by chemical decomposition, with which they are said to be charged, while others think that they are imbued with a peculiar heat which is curative. To my mind, the salutary and hygienic effects of these waters (as far as they are productive of good) reside in their heat alone. The stimulation of the capillaries and of the circulation generally, including the lymphatic system, as well as the stimulation of each individual cell of the skin, by the heated water, and the brisk frictions subsequent to the bath, I think act as profound vitalizing agents and are productive of great benefit. But there are many accessory conditions appertaining to a sojourn at these thermal springs which play a very important part in the hygienic reconstruction which is often gained. Having taken the long journey, after much anticipation, preparation, and often at great sacrifice in the matter of time and money, patients arrive at the springs with an earnestness of purpose and with a fixed resolve that they will make any personal sacrifice, particularly in the matter of creature comforts, in order to be benefited or cured. They for a time undergo personal reformation, and usually sedulously refrain from alcoholics, from tobacco, from the card-table with its late hours, and from sexual indulgence. They, as far as they can, leave behind them all business and social cares; they eat regularly, go to bed early, and perhaps sleep late, and, in short, conform as far as possible to the most rigid hygienic rules. They have an entire change of scenery and of domestic relations, and, in fact, of the whole routine of life. They breathe a pure air, have abundant opportunity for outdoor exercise, and generally enjoy rest and contentment. Certainly, no one can ask for more auspicious auxiliaries to medical treatment.

It has been claimed that the sedation and tendency to sleep induced by the baths at the Hot Springs are peculiar and due to some occult effect of the waters. It is true that, as a rule, hot baths usually have

an opposite effect, but I have many times seen the same soporific result follow hot salt-water baths taken at our seaside resorts. In some instances I have found that excitement and sleeplessness followed baths taken at the Hot Springs.

Let us now consider the conditions in which benefit may accrue to syphilities who undergo treatment at the Springs. While I am disposed to give this celebrated resort its full meed of praise in the treatment of syphilis, I must here state my emphatic belief that in the majority of cases there is not the slightest necessity of going so far away to attain a cure, and that a very large number of the cases which go there do so because they have not been properly handled at their homes. In other words, the faultiness in the physician's methods of treatment and his shortcomings in the management of his patients are, in many instances, the real reasons why patients have to betake themselves so far away for relief. Furthermore, in very many instances the apathy of the patient, his carelessness and irregularity in following treatment, his absorption in business matters, his often flagrant want of attention to health and hygiene, so impair his physician's efforts that he perhaps obtains no good, and possibly grows steadily worse.

At no time during the primary stage of syphilis does treatment at the Hot Springs offer any advantage whatever. Treated on the classical lines, the chancre can always be healed, and in the rare event of phagedæna we are certainly as well equipped at home as our colleagues at the Springs. In like manner, no peculiar benefit can be derived in the early exanthematic stage. At this time the general health and nutrition of patients is usually good, and they, as a rule, respond readily to the action of mercurials.

All fair-minded men, however, who have much to do with the treatment of syphilis must certainly admit that in certain cases and in certain conditions a sojourn, under proper medical care, at the Arkansas Hot Springs is very often followed by the most gratifying results.

I myself have sent many cases to colleagues at the Springs, and have never had occasion to regret it; and I am glad that as a therapeutic resource we have these springs at our command in cases of urgency and need. While in general we can readily manage the cases of ulcerating syphilides, including the impetigo form, the ecthyma form, the rupial, and the serpiginous, we certainly do find instances which are rebellious and which improve wonderfully at the Springs. In these cases, however, we have usually, as complicating conditions, anæmia, debility, and malassimilation, in which event specific medication is more or less slow or impotent in its working. Many of these cases have run the gamut of mercurial and iodide-of-potassium treatment, and these remedies then act as depressants, rather than as anti-

syphilities. In such cases the change of scene and air and the baths are of inestimable value.

The matter may be summed up in this way: In many cases where cachexia, due to any cause, and intolerance of the usual specific medication, are found to exist and the activity of the syphilis still persists, treatment at thermal springs is indicated.

In many instances of gummata in broken-down subjects the baths are often of great value, and I have seen gummatous infiltration in the throat much benefited by the treatment used at the Hot Springs.

The osseous and articular lesions of syphilis may be only temporarily benefited at the Springs, but late syphilitic rheumatism, rheumatic conditions complicated with visceral disease, combinations of gout and syphilis, late syphilitic cachexia without visible lesions, and the generally broken-down state of old syphilities addicted to alcoholic and other indulgences, are all frequently much benefited, and some cases thereafter enjoy fairly good health.

When, owing to the usual causes already spoken of, syphilis does not go on auspiciously to its extinction, a sojourn at the Hot Springs is often of decided value for its moral as well as its physical effects. Such patients when at home live in a rut, and, while they perhaps keep at their daily affairs, they are depressed and perhaps more or less despondent. Change of scene, of air, of habits and customs enlivens them, while previously the treadmill of their existence had made life burdensome.

In persistent and chronic cerebral and spinal affections of the most varied character due to syphilis, and the various morbid states and dyscrasiæ which so commonly complicate it, protracted sojourns at the Hot Springs are often productive of marvellous results. In these cases very often the tolerance of antisyphilitic agents, which are so necessary to relief and cure, is obtained, and patients are often rescued from invalidism and death.

But there are still other considerations offered by the treatment pursued at the Hot Springs. Many cures are there made for the reason that mercury is not withheld from the sufferer, as it had been at home. Many of the Hot Springs physicians are alive to the fact that the methods of treatment pursued by many surgeons in the large cities are faulty. These latter often fail to cure their cases for the reason that they use mercury in too small quantities. They do harm with the drug rather than good. They do not eradicate the disease, but by their timorousness and want of vigorous treatment induce a condition of hydrargyrosis—a mercurial cachexia. I have seen many instances of this complication. At the Springs, after proper preparatory treatment, they receive mercury liberally, and it acts well upon them physically and morally.

This fact, to my knowledge, will account for many seemingly surprising cures made at the Hot Springs.

Then, again, there are teachers who inculcate the doctrine that mercury is only beneficial in the early part of syphilis—let us say in its first year. After that it is by them taught that its function is ended and the era of iodide of potassium begins. This fallacious doctrine often works sad havoc on patients, and they hie them to the Springs to regain their health and to get their sovereign panacea, mercury. If this remedy had been administered at the patients' homes, they would not have had the necessity of knocking at the Hot Springs surgeon's door and of begging for relief.

In like manner, in many instances the administration at the Springs of iodide of potassium in large and increasing doses has cured cases which languished in suffering and disease at home because only small doses were given. But I think the tendency to minimize the dose of the iodide of potassium is not as widespread among the profession as it is in the case of the mercurial preparations.

In the foregoing paragraphs I think I have shown that the successful treatment of syphilis at the Hot Springs is in many instances due to the dereliction and shortcomings of the home physicians, who were imbued with faulty ideas as to the dose of mercury necessary for cure, and often to the method of use.

I think that in a large number of cases (and I have seen scores of instances) patients have resorted to the Hot Springs for treatment of syphilis because their cases were not actively handled, were not thoroughly medicated, or were treated in a free-and-easy, happy-go-lucky manner, or were treated in a too stereotyped, narrow-gauge way at their homes. But here it is well to remember that many cases of syphilis do badly or go wrong in consequence of the apathy and want of care and of the indulgences on the part of the patient.

Furthermore, there is another very important consideration regarding syphilities at the date of the onset of their malady. Though they may have been deeply impressed with the gravity of their condition, they often become lulled into a feeling of false security after a sojourn at the Springs. I have seen many patients who in later years have suffered severely from syphilis, and who on the breaking out of their disease had hastened to the Hot Springs. They there underwent a course of treatment, and the evidence of their disease vanished. Thinking that besides the skill of man they had, as we may say, supernatural aid from the wells of Nature, many have gone away with a sense of happy security, imagining themselves cured; others have thought that a similar sojourn a few months or a year later was all that was necessary; while others, again, have decided to apply for medical aid only if they should notice later manifestations of their disease. This glamour of

security and health conferred by the mystery of the waters has brought many a man to invalidism and death through some late-appearing cerebral or visceral lesion of syphilis.

There is, however, no necessity for taking such a long journey, for other springs will do equally as well. In Virginia, and elsewhere in America, there are hot springs which will act as valuable adjuvants in the treatment of syphilis, and this is the sole action of the Arkansas springs. Take away the mercurial ointment and iodide of potassium from any thermal spring, and its business will soon close up for want of patronage.

During the summer months syphilitic patients can enjoy pure air, beautiful scenery, and repose and quiet at Richfield Springs, where also they may have any form of bath, and may under medical advice partake of natural sulphur waters. There is nothing to be obtained at the Arkansas Hot Springs which cannot be had at Richfield.

The internal use of the waters of the Hot Springs of Arkansas has been claimed to be very beneficial in the treatment of syphilis, and the idea is fostered in that happy valley that these waters are in a measure specific. Such, however, is not the case. They simply act as diaphoretics and diuretics, and can at any health resort be replaced by a draught of hot milk, hot tea, a little gin and hot water, a little essence of ginger and water, or any other pleasing and innocuous hot drink.

In the section on Mercurial Inunctions the question of the value of sulphur water has been considered. I may here repeat that the experience of physicians at Aix-la-Chapelle and at other springs which give forth sulphur waters goes to show that in certain cases, particularly chronic ones, these waters, in combination with proper mercurial treatment, act very beneficially as diaphoretics and eliminants. My reading and experience teach me that there are no criteria in any case by which it may be stated that sulphur waters are indicated, or that they will probably produce benefit. The only course to pursue is to try them, and be guided by the results observed. It has been claimed that these waters tend to advance the elimination of mercury from the system of those who have been long and injudiciously dosed with that drug. In support of the statement, chemical analyses of the urine in such cases have been made and published to show that mercury has thus been ferreted out and thrown off, but in many of them it is very probable that the synchronous employment of hot sulphur-water baths has had much to do with the eliminative process.

Still further, it is claimed that the internal use of sulphur waters has a direct action in preparing the system to receive mercury and throw off the syphilitic poison. This assertion may be partly true, but we should always remember that change of air and scene, rest, and improvement of the patient's habits and regimen also have much influ-

ence in preparing him to receive treatment and in making his tissues less vulnerable to the syphilitic poison.

Liebreich has stated than when mercury acts slowly or ceases to act the original susceptibility of the system to it may be restored by a generous diet and an abundance of salt. I have many times witnessed marked improvement in old cases of syphilis, which had hitched and halted in a mercurial course, from daily hot sea-baths. In these cases, however, a change of air and scene were also essential factors of benefit.

The subject of the influence of hot baths in the treatment of syphilis has of late years attracted much attention, and one of the most valuable papers upon it is by Dr. Vasily K. Borovsky,[1] who investigated the subject at the suggestion of Professor Tarnowski. This observer carried out his clinical observations on 28 syphilitic patients. Heat was employed in the form of (*a*) ordinary hot-water baths at 98° to 104° Fahr. of thirty minutes' duration; (*b*) artificial sulphur-baths (prepared by adding 1 pound of sulphur to each bath at from 100° to 104° Fahr. of from twenty to thirty minutes' duration; and (*c*) hot-air baths at from 180° to 200° Fahr. of from fifteen to thirty minutes' duration. Dr. Borovsky's results may be summarized as follows: 1. Both tepid and hot-water baths, as well as those of sulphur and hot-air, invariably increase the elimination of mercury in the urine. 2. The elimination proceeds more energetically the higher is the temperature to which the patient is exposed. 3. The cause of such intensified excretion of mercury should be sought in an increase of the systemic metabolism, accompanied by the disintegration of mercurial albuminates. 4. A mercurialized patient's organism actually can be completely freed from mercury by means of a systematic employment of heat in one form or another. 5. In such cases, when the elimination of mercury ceases spontaneously, it can be made to reappear by the use of hot baths. 6. Mercurial stomatitis can be cured by heat more quickly than by any other means. 7. Hot-air baths, while inducing an enormous perspiration, promote the elimination of mercury also through the sweat-glands. The total quantity of sweat excreted during a bath amounts to 400 c. cm. and more; that of mercury in the sweat to 1.6 milligrams and more per 400 c. cm. Hence, as a means for freeing the patient's system from mercury they should be preferred to all other baths. 8. The appearance of mercury in the sweat naturally suggests that diaphoretics generally are useful adjuvants in the treatment of mercurialism. 9. Tepid baths (88°

[1] "On the Influence of Hot Baths on the Elimination of Mercury in the Urine," *St. Petersburg Inaugural Dissertation*, 1889; and *British Journal of Dermatol.*, 1889, vol. ii. p. 22. (I am much indebted to Dr. Valerius Idelson for his admirable abstracts of recent papers in Russian medical journals which have appeared in the above-mentioned journal.)

Fahr.) should only be resorted to in cases of hydrargyrosis in which higher temperatures are contraindicated on some grounds. 10. Hot-air baths are borne by patients better than hot-water ones (98° Fahr.), which sometimes give rise to fainting. 11. Hot-air baths at 170° or 180° Fahr. of twenty minutes' duration were borne better than those at from 140° to 160° Fahr. of thirty minutes' duration, while the physiological and therapeutical effects of the former are practically identical with those of the latter. 12. In persons having an idiosyncrasy against mercury the employment of heat sometimes affords the possibility of safely continuing mercurial treatment. 13. Hot-air baths, while inducing intense thirst, involve an increased ingestion of fluids, which in its turn leads to an increase in the bodily metabolism. 14. As regards the elimination of mercury from the organism, artificial sulphur-baths do not offer any advantages whatever over other baths. 15. The time required for the complete excretion of the metal from the patient's system varies according to the total amount ingested, individual peculiarities of the patient, temperature of the baths, etc. 16. A simultaneous treatment of syphilis by mercury and heat may sometimes effect a cure more quickly than a mercurial treatment alone. 17. The heat-treatment alone (one or two baths daily for a fortnight), however, usually proves powerless to bring about a cure. 18. In patients with diseased vascular system the use of hot water requires great caution.

The practical deductions to be made from this study are that as an adjuvant to a mercurial or a mixed treatment heat, dry or moist, may be employed in certain conditions and with certain restrictions, with much benefit. Thus it is well to order patients taking mercury to take one or two hot baths each week on going to bed. They undoubtedly increase the potentiality of the drug and benefit the patient by increased elimination and metabolism. They may also take Turkish or Russian baths. Baths of moist heat with mercurial fumes have already been treated of in this article.

The subject of the local treatment of syphilis by heat has recently been prosecuted by Dr. Kalashnikoff[1] of St. Petersburg upon thirty-two hospital patients. In cases of generalized syphilides one of the patient's upper or lower extremities (the most affected one) was placed in a hot bath, 117° or 118° Fahr., for half an hour twice a day (morning and evening). During the intervals the limb was constantly kept wrapped in a warming compress. In cases of syphilides situated on the hands, buttocks, neck, face, genitals, and such regions of the body generally, where local baths were impracticable, either hot fomentations or an india-rubber bag containing hot water, 115° or 120° Fahr., were applied

[1] "On the Local Treatment of Syphilis by Heat," *St. Petersburg Inaugural Dissertation*, 1889.

to the part for an hour twice daily, and in the intervals constant warming compresses were adjusted. Kalashnikoff found that local heat affords a powerful means for promoting the absorption of syphilitic products in the region treated. Primary, secondary, and tertiary lesions subjected to the influence of heat, 117° or 118° Fahr., were made to disappear more quickly than by mercurial treatment. Under a simultaneous treatment by heat and mercury the resolution of syphilides was even more rapidly accomplished. Kalashnikoff found that in cases of relapse such regions as have been treated by heat either remain free from any rash or are affected in a strikingly slighter degree in comparison with other regions of the body. The beneficial effects of heat are attributed to its inducing cutaneous hyperæmia, accelerating the local circulation, raising the temperature of the blood, and modifying the condition of metabolism. According to Kalashnikoff, it is probable that, while promoting the absorption of syphilitic infiltrations, heat at the same time destroys the syphilitic virus itself. Care as to the fitness of the patient to this treatment and to the details of the latter should be exercised.

The efficient and energetic action of local heat in syphilis has been attested by Domashneff, Stepanoff, Fischer, Radestock, and others, and it should be borne in mind as an adjuvant remedy of reserve. But in its employment watchfulness and care are very necessary. I am fully in accord with Professor Tarnowski,[1] who, while admitting that heat applied externally can lead to a rapid absorption of cutaneous syphilides, emphatically objects to regarding their disappearance as being identical with cure of the disease. The truth is, probably, that external lesions are only displaced and driven to other parts of the economy, such as viscera, heart, arteries, brain, etc. Thus it should never be adopted as a method of cure, for it may be injurious or even dangerous. It may, however, in proper cases be employed moderately and carefully as an adjuvant to general methodical and local treatment.

Sublimate baths are very often of much benefit in extensive rashes of the skin. In cases of papular, scaly, tuberculous, or ulcerative syphilides these baths, at a temperature of 100° Fahr., are frequently the means of causing the prompt disappearance of the lesions. From 4 to 8 drachms of the sublimate may be used in the bath, to which also may be added double the quantity of chloride of ammonium or common salt. The baths should be taken at night, and the patient should remain in them from fifteen minutes to half an hour, the time being gauged according to the sensations produced by them. When strong sublimate baths are taken rather frequently, it is necessary to diminish or suspend the mercury taken by the mouth.

A watery solution of corrosive sublimate (1 to 3 grains to the ounce)

[1] *Vratch*, 1889, No. 5, p. 156, and No. 9, p. 238.

is often of much benefit when applied locally on lint or cotton as a compress for dermal lesions, periosteal swelling, onychia, etc. Detmold[1] recommends for external use a watery solution of corrosive sublimate (2 grains to the ounce) which he instructs patients to rub well upon each extremity, using half an ounce at an application night and morning. The results of this treatment were most gratifying, and Detmold resorts to it to the exclusion of all others. The application does not irritate the skin nor produce salivation, though it was thought that griping pains in the stomach were observed after its continued use. This treatment is by no means new, but it has been brought into prominence by Detmold.

Gargles of corrosive sublimate, varying in strength from 2 to 8 grains to 8 ounces of water, are often very beneficial in buccal and pharyngeal ulcerative lesions.

It is well to remember Van Swieten's liquid, for it is capable of extended use as a local application, and may also be taken internally. Its formula is as follows:

℞. Hydrargyri chloridi corrosiv.,		gr. ij;
Alcoholis,		f℥iij;
Aquæ dest.,	q. s.	f℥iv.—M.

One tea-spoonful contains $\frac{1}{16}$ of a grain of corrosive sublimate.

This preparation is particulary adapted for local treatment of secondary and tertiary lesions about the head, face, and neck.

Among the curiosities of syphilitic therapeutics may be mentioned the electric-sublimate baths exploited by Ehrmann and Gaertner.[2] These baths contain three drachms of sublimate, which salt, it is thought, enters the system by means of an electric current of an intensity of 200 milliampères. The baths are given every day or every second day, and should be of half an hour's duration, though the current is only to be kept on for fifteen minutes. The authors of this method of treatment claim—1st, that the introduction of mercury takes place in the same way as when inunctions are used, and that the stomach and liver are spared; 2d, that absorption takes place by almost the whole surface of the skin, upon which the mercurial also exerts a local action; 3d, that the quantity of mercury absorbed is proportionate to the intensity and duration of the current, and that exactitude of dose is thus made possible; 4th, that it is painless and without danger. Under this treatment the urine shows the presence of mercury after sixteen to thirty baths; hence absorption is not rapid. After a time it was found

[1] "Diagnosis and Treatment of Syphilis," *Med. News*, March 8, 1884.

[2] "Le Bain electrique au Sublimé, experience sur un Nouveau Traitement mercurial," *La Semaine médicale*, 1889, p. 438; and "Du Traitement de la Syphilis par les Bains electriques au Sublimés," *Ibid.*, 1890, p. 357.

that the system did not take up any more mercury. Toxic effects, such as diarrhœa, salivation, and scaling eczema, were noted in a few cases.

Another method of treatment of syphilis has been proposed by Brémond[1] which is claimed to be successful when other methods fail. The patient is placed in a box with his head out, and a sprayer projects at him, all over his body, numerous jets of steam containing particles of sublimate or iodide of potassium.

Local, Special, and Regional Treatment.

Treatment of Chancres.—When seen at a very early date upon the male genitals, the chancre usually appears like a minute round or oval excoriation, or as a papule with a scaly or an oozing surface. So much does this, the earliest of all evidences of syphilis, resemble simple benign lesions that mistakes are very liable to occur, and a chancre may be diagnosticated as an excoriation, an abrasion, or as a simple inflammatory papule, or *vice versâ*. Under these circumstances the physician cannot be too careful and guarded in the diagnosis of any seemingly insignificant lesion upon the penis. It is well to warn a patient not to indulge in sexual intercourse for at least two weeks, by which time the nature of the lesion will be beyond question, since if it is benign it will commonly heal under simple treatment and cleanliness, and if it is an incipient hard chancre its evolution will continue and its appearance will indicate its character. It is of the utmost importance that no stimulating or escharotic applications should be made to these small lesions, for very good and sufficient reasons. In the first place, if the lesion is simple in nature, burning it with acid or other caustic will not destroy it, but simply transform it into an inflammatory nodule, which may present a striking resemblance to a young hard chancre, and thus doubt and uncertainty of mind are induced or an error in diagnosis is the result. If the lesion is an incipient chancre, it is a localized specific neoplasm, which cauterization, however severe, cannot possibly destroy, but it can cause a complicating œdema which may be troublesome to cure. Therefore it may be stated as a golden rule that we must not lay violent hands on these seemingly and perhaps insignificant lesions. Any breach of surface, therefore, should be kept scrupulously clean by washing, and its surface may be covered with lint or absorbent cotton moistened with water. In many cases a water dressing is sufficient, but mild solutions of sublimate (1 to 1000, 2000, or 3000) may be applied, or very dilute watery solutions

[1] "Traitement, de la Syphilis par l'Absorption cutanée des Medicaments," *La Semaine médicale*, 1889, p. 284; and "Traitement de la Syphilis aux Diverses periodes de la Maladie, par l'Absorption des Medicaments par la Peau," *Journal des Mal. cutan. et Syphilis*, vol. i. 1890, p. 297.

of carbolic acid. These applications may be made every two, three, or four hours. Peroxide of hydrogen 1 part and water 6 parts make a solution which will produce an antiseptic effect. As the hard chancre grows larger it may be treated with black wash, with yellow wash, or the red wash which is made as follows:

℞. Zinci sulphatis,	gr. viij;
Spiritus lavandulæ comp.,	ʒij;
Aquæ,	q. s. ad ℥iv.—M.

It must be understood that the therapeutical effect of these lotions is simply protective and slightly stimulating. They prevent irritation and ulceration by keeping the parts clean and aseptic. The chancre offers a nidus for pus-producing microbes, and when it is not large antiseptic washes are all that is required in the way of treatment.

Petersen[1] has used a solution of yellow and blue pyoktanin of Merck (1 to 1000, or even 1 to 100) upon hard and soft chancres, and he claims that he has had good results. The chief advantages are that it is inodorous and in antiseptic power not inferior to iodoform. The stain of blue pyoktanin may be removed from the hands by washing them well with a strong soap-lather and, after drying, pouring alcohol over the spots. Dr. E. R. Palmer of Louisville informs me that he has employed with much satisfaction, in the treatment of hard and soft chancres, a watery solution of fuchsine (1 drachm to the ounce), which he paints well over the morbid surface, which he then covers with absorbent cotton.

Chancres covered with a false membrane, thick or thin, those which show a tendency to become necrotic upon their surfaces, or in which a decided tendency to ulceration is seen, may not be sufficiently influenced by the foregoing applications. In these cases it is important that a decidedly caustic effect should be produced. In cauterizing hard as well as soft chancres carelessness and recklessness must be carefully avoided. The lesion to be treated should first be carefully washed with soap and water, and then irrigated with a 5 per cent. carbolic solution. Then it should be dried and a solution of cocaine applied to it, and then it should be dried again. We no longer use the carbo-sulphuric paste (sulphuric acid and charcoal) nor the Vienna paste (chloride of zinc and flour), for they are difficult of application and too caustic in their effects. Cauterization by heat is repugnant to patients and not necessary. As a routine application nothing is better than fluid carbolic acid or pure nitric acid. These agents should be sparingly, carefully, and not frequently applied to the surface of the sore,

[1] "Die Desinficirende Wirkung der Anilinfarben von Merck Pyoctanin," *St. Petersburg med. Wochenschrift*, No. 27, 1890.

and not beyond it. A small quantity of cotton rolled on the end of a wooden toothpick offers the most effective and satisfactory means of application. It may be well to mention that Güntz[1] of Dresden advises the use of concentrated muriatic acid, after which he covers the surface with a little bicarbonate of sodium, and then applies cold compresses. In case the surface cauterized is quite large, it is well to send the patient at once to his room, where he should lie down. It is well to bear the fact in mind that this destructive treatment is only indicated in cases in which the surface of the sores is unhealthy and shows no tendency to heal. After cauterization it is necessary to apply antiseptic remedies in the powder form. It is always imperative that these lesions should be carefully washed twice a day, and the patient should be warned to destroy, preferably by fire, all linen used in the cleansing, and to be careful not to touch with soiled fingers any article which others may handle. Among antiseptic powders iodoform still holds its position without a peer or rival. New remedies come and go, but this one stays by us. It may be said without fear of contradiction that for the dressing of ulcers and wounds about the genitals, male and female, there is no remedy so efficient or which has such a wide range of usefulness. Its odor is of course objectionable, but with care much of this inconvenience may be obviated. In the first place, the powder must be very carefully and sparingly put on the surface, and not allowed to drop on sound parts or upon the clothes. Then, if the lesion is under the prepuce, the odor may be kept at a minimum by packing cotton in the preputial orifice. If the lesion is on an uncovered part, it should be enveloped in absorbent cotton and then covered with gutta-percha tissue. A little care and ingenuity will do much to dissipate a patient's disinclination or repugnance to the use of this drug. Though many drugs have been recommended as having the power of deodorizing or disguising the odor of iodoform, none, in my judgment, have proved successful. By far the best deodorant is cumarine, which in small quantities may be added to iodoform. It must always be remembered that this powder is only applicable to unhealthy and necrotic surfaces, and that when a smooth healing surface has been produced its use must be discontinued and one of the simple stimulating or antiseptic lotions or powders should be substituted.

Iodol has now been on trial a number of years, and has proved itself to be a feeble agent, comparable in its effects to subnitrate and subiodide of bismuth. Where little is required it may be used and may prove satisfactory, but in severe cases this powder forms a crust over the surface, and beneath this the destructive process goes steadily on. When there is danger ahead never trust to iodol. Aristol is scarcely

[1] *Die Behandlung der Syphilitischen Geschwüre nach den Neuren Methoden*, Leipsic, 1891.

more efficient in really active lesions than is iodol. There are those who *see* good effects in every new preparation, but they are usually not careful and critical judges. The fact that aristol will act seemingly favorably upon a chancre whose course is attended with slight ulceration and destruction is no evidence that in a graver exigency it will prove efficient. In my experience (and I have tried it extensively) aristol has shown no decided therapeutic power, certainly none more marked than that shown by iodol, subiodide of bismuth, sub-benzoate of bismuth, and other such powders. Though it is odorless, it leaves an objectionable sticky feeling on the fingers and on the parts to which it is applied. If you have a bad case, be sure to use iodoform; and if you have a mild case that any indifferent powder will help, prescribe iodol, aristol, or some other new remedy. If you do nothing else, you will show that you are progressive and that you keep abreast of the times, and among some that will have its effect.

Many chancres in a necrotic state will be much benefited by the application of calomel covered with cotton. Salicylate of mercury has been recommended for this purpose, but it should never be applied in its pure state, for it exerts an unpleasant irritant and destructive action upon the mucous membrane. It may be combined with talcum powder or starch in the proportion of 1 drachm of the mercurial to 4 or 6 drachms of the inert powder. Salicylic acid is uncertain in its effects, and if applied in its purity causes irritation.

The cup of happiness of the seeker after therapeutic novelties must certainly now be nearly full, for every month brings us a new antiseptic remedy, usually from Germany, which is to supplant iodoform. In order that I may not appear behind the times, I will enumerate these new remedies and their sponsors, so that anyone can put them to a practical test:

Baziliviteh[1] claims that he has had excellent results in ulcerated chancres by freely powdering their surfaces twice a day with antifebrine (Merck). He further claims as advantages that it is cheap, free from odor, and will not give rise to dangerous phenomena from absorption.

Salol has also been extolled by Salsotto[2] and others in the treatment of hard chancres, but the drawback to its use is the fact of the difficulty of obtaining it in sufficiently fine powder that it will not act as an irritant. A combination of salol one part and some inert powder two parts may be of service in some mild cases of ulcerating chancres.

Sozo-iodol has been extolled by Lassar,[3] and it may do good service in some mild cases.

[1] *Meditzinskoïe Obozrenië*, Nos. 13 and 14, 1890.

[2] "Il Salol ed il su. uso terapeutico in alcuni morbi venerei," *Giornale Ital. del mal. Veneree e della Pelle*, 1887, p. 345, *et seq.*

[3] "Ueber das Sozoiodol," *Therapeut. Monatshefte*, Nov., 1887.

The subgallate of bismuth, also called dermatol, has been proposed by Heinz and Liebrecht[1] as a substitute for iodoform. They claim that it has decided healing properties and that it is inodorous and non-poisonous. An extended use of this has not so far been made, but C. A. Powers[2] at the New York Hospital up to date thinks that it is as efficient in healing ulcers as iodoform. It will be interesting to learn what he thinks of the remedy a year or two hence.

Sansoni[3] of Turin, among other remarkable qualities, claims that euphorin (Merck) is better than any other remedy as an application to obstinate ulcers. I suspect that within a short time we shall have some highly laudatory accounts of the effect of this agent in the cure of chancres.

Europhen, introduced and recommended by Goldmann,[4] is said to have a brilliant future before it as an antiseptic.

And, lastly, sulfaminol (Merck) comes before us as an inodorous, painless, anti-suppurative remedy, which Robertson[5] regards as superior to iodoform. It has not as yet been used in the treatment of chancre.

It must not be forgotten that the main benefit of all antiseptic remedies for chancre consists in their power of preventing ulceration, and by this means they hasten the cure. It is important, however, that a specific action should be brought to bear on all chancres which show a tendency to become indurated. Having by the proper means produced a healthy surface, the chancre should then be treated with mercurial ointment. The surface having been washed and rendered as nearly as possible aseptic, a layer of absorbent cotton or lint well smeared with this ointment should be placed upon it, and then kept in constant apposition. It is important that the dressing should be renewed two or three times a day.

Chancres of women require the same general treatment as is used for those of men. In many cases they run their course and disappear without treatment, and perhaps without recognition. In some cases, however, they are obstinate and persistent, and require time and care for their removal. It is always imperative that the vagina and vulva should be kept particularly clean in women having syphilitic chancres. They should use frequent irrigations of hot water to which borax, alum, sulphate of zinc, or carbolic acid is added. Then the parts should be kept as dry as possible, for which purpose tampons of absorbent cotton are very effective. In some cases extensive and troublesome indurating œdema becomes a complication of the vulvar chancre, and its presence

[1] *Berliner klinische Wochenschrift*, No. 24, 1891.
[2] *Medical Record*, October 17, 1891.
[3] *Therapeutische Monatshefte*, Sept., 1890.
[4] *Pharmaceut. Zeitung*, July 15, 1891.
[5] *British Med. Journal*, August 29, 1891.

means a long siege of annoyance and perhaps suffering. When possible, chancres in the female should be dressed with mercurial ointment in the manner above described. If the induration is extensive, or if it shows a tendency to spread, it is well to cover the chancre and a liberal area of the parts around it with the ointment. In some cases a strong calomel or white precipitate ointment may be used in place of the mercurial ointment.

Treatment of the Syphilides.—ERYTHEMATOUS SYPHILIDE.—As a rule, internal medication causes this syphilide to disappear promptly, but it is always well to hasten its involution by sublimate baths, mercurial vapor baths, or by inunction. Upon the face, neck, hands, and wrists this syphilide may be persistent, and its disappearance may be hastened by using the following ointments:

℞. Hydrargyri ammoniati *vel* hydrargyri oxidi rubri, gr. xx;
Unguent. aquæ rosæ, ℥j.—M.

℞. Hydrargyri subsulph. flav., ʒss;
Vaselini, ℥j.—M.

The latter is much thought of by Mauriac. In some cases of persistent eruption about the face the following lotion may be used:

℞. Hydrargyri chloridi corros., gr. iv;
Aquæ cologniensis, ʒij;
Aquæ, ad ℥iv.—M.
Apply three or four times a day.

The erythematous syphilide is not uncommonly complicated by a seborrhoic process, as shown by the development of orange-red patches of scaly skin upon those parts of the forehead, glabella, alæ nasi, and around the mouth, on which the sebaceous and sudoriferous glands are most abundant. This condition is also found on the scalp and upon the sternal region. For these cases resorcin in liquid or ointment form is very efficient. The following ointment may be used, after well washing the parts with the simple tincture of green soap (tinctura saponis viridis):

℞. Resorcin., ʒss–ʒj;
Acidi carbolici, gtt. xx;
Unguent. aquæ rosæ, ℥j.—M.

THE PAPULAR SYPHILIDES.—These eruptions are usually amenable to internal medication if they are attacked early. But even if internal treatment is ordered, one or other of the external methods should be used occasionally, in order to expedite their involution. The small

and large miliary papular syphilides are the ones which are most resistant to remedies general and local. They, like all stubborn papular syphilides, should be treated by hot baths, either alkaline or sulphur, and by frictions of mercurial ointment. Massage has recently been recommended by Balzer[1] as an adjunct in the treatment of these syphilides. Mercurial ointment is to be rubbed into the surfaces firmly and deeply, each seance occupying from twenty minutes to half an hour. I have used this method of treatment for many years, and have long since become convinced of its efficacy and necessity in many cases. In some cases of extensive pigmentation following syphilitic eruptions baths and massage treatment have been followed by striking results. Scaling eruptions of the palms and soles, the sequelæ of the erythematous and papular syphilides, are peculiarly obstinate and prone to relapse. They may be benefited by local sublimate baths, as recommended by Sigmund, and, more recently, by Gilles de Latourette.[2] Hot alkaline baths with the addition of bran are also very efficient. After immersion of the parts they should be enveloped in a mild form of mercurial ointment, as follows:

℞. Unguent. hydrargyri nitratis, ℥ij;
Olei rusci, ℥j;
Unguenti, ℥j.—M.

℞. Unguent. hydrargyri nitratis, ℥ij;
Olei cadini, ℥j;
Vaselini, ℥j.—M.

℞. Hydrargyri ammoniati *vel* hydrargyri oxidi rubri, gr. x–xxx;
Olei rusci, ℥j;
Vaselini, ℥j.—M.

Such is the inflammatory condition present in some cases that a soothing ointment is required, as follows:

℞. Unguent. diachyli (fresh), ℥ij;
Unguent. hydrarg. nitratis, ℥j;
Olei rusci, ℥ss.—M.

In some cases of localized eruption a mild solution (from 1 to 4 grains to the ounce) of bichloride of mercury in flexible collodion or traumaticin may prove very efficient. Sometimes, when the tendency to scaling is very great and persistent, chrysarobin may produce happy results.

[1] "Contribution à l'étude du Traitement local des Syphilides; Utilité de Massage," *La France médicale*, Jan. 9, 1891, p. 18, *et. seq.*

[2] *Progrès médical*, June 10, 1886.

CONDYLOMATA LATA.—These lesions are found around the genitals of the male and female, in the axillæ, under the breasts of fat women, in the labio-nasal sulcus, and about the umbilicus. They are large, flat, overgrown papules, with excoriated oozing surfaces and a tendency to great multiplication and to exuberant development. In their very early stages, when not very salient, simple washing with carbolic water, dusting with an inert powder, and covering with absorbent cotton will cause them to flatten and disappear. In general, the old Ricord treatment is to-day unexcelled. By this the parts are carefully washed with a solution of chlorinated soda (Labarraque's solution 1 part, water 6 or 8 parts), dried, dusted freely with calomel, and covered with cotton. Keeping the surfaces of these lesions dry by the covering or interposition of some soft cotton or linen fabric materially assists in causing their early involution and prevents their further reproduction.

When these lesions are not very much elevated their subsidence may be hastened by carefully applying to their surface once a day, after washing with soap and water, a solution of nitrate of silver (30 grains to the ounce). It is unwise to treat them with the nitrate of silver stick, for by doing so much dermatitis may be produced and the cure much delayed. Powders of resorcin or salicylic acid with starch and boric acid are also serviceable in these cases.

In hospital and dispensary practice we frequently encounter cases in which condylomata lata have become much hypertrophied, and perhaps exuberantly fungating. In these cases the foregoing measures are ineffectual, and more heroic treatment is required. In this event the parts, after careful washing and drying, may be painted with either of the following solutions:

℞. Hydrargyri chloridi corros.,	gr. x–xx;
Collodii flex.,	℥j.—M.

℞. Acid. salicylic.,	ʒss–ʒj;
Chrysarobin,	ʒss;
Collodii flex.,	℥j.—M.

On the Continent, and largely in Germany, Plenck's solution is much used in these and other hypertrophic syphilitic lesions. The formula is as follows:

℞. Hydrargyri chloridi corros.,	℥j;
Aluminis,	℥j;
Plumbi acet.,	ʒj;
Camphoræ,	ʒj;
Alcohol.,	f℥xij;
Aceti,	f℥xij.—M.

This makes a solution with a decided sediment, and on shaking it turbidity is produced. It may be applied with a camel's-hair pencil, after proper preparation, to these lesions. It should not be used unless the application can be followed by cold compresses, for it may produce pain. It is therefore more especially a hospital remedy. Hoffman[1] reports the case of a woman having condylomata about the genitals and anus, which were cauterized by a physician who threw away the supernatant liquid from Plenck's solution, and used the turbid sediment. On reaching home the woman suffered atrocious pains, rolled on the floor in agony, and unsuccessfully tried to hang herself. At the hospital, later, it was found that the parts were much inflamed and swollen, and the woman was suffering from abdominal pain, vomiting, and diarrhœa. After eight days' suffering she died. These facts should certainly act as a warning in the use of very caustic mercurial remedies on these highly vascular lesions. Kaposi[2] thinks that Plenck's solution should be discarded, and that emplastrum hydrargyri should be substituted for it. But in many cases this plaster cannot be applied. So that Koch's[3] suggestion, that the remedy be retained and used in diluted form, is wise, for this solution sometimes acts well when other applications fail. It certainly never should be used after decanting its supernatant liquid. Though Hallopeau[4] has recently recommended (and his paper has been largely quoted) the use of the acid nitrate of mercury in the treatment of anal condylomata, it must be remembered that it is a very caustic and very concentrated mercurial solution, and that cauterization by it of a simple small ulcer on the os uteri has been known to cause salivation. If used at all, the greatest caution should be observed, and only a small surface should be touched with it.

I have seen much benefit, in some instances of large and not closely aggregated condylomata lata, from the free but careful use of the curette, the operation being followed by thorough antisepsis. For a limited number of cases this treatment may prove effective.

A more radical procedure is one recently advocated by Baudier,[5] who used it largely in Leblond's service. It consists in the application of the thermo-cautery to large and persistent condylomata. I have long employed this method in rebellious cases, and with prompt and good results. But great care must be taken in the application. The parts must be thoroughly cleansed, and the hot instrument passed

[1] "Sublimat Vergiftung nach Aetzung von Kondylomen mit Solutio Plenckii." *Wien. klin. Wochenschrift*, No. 16, p. 301.

[2] *Ibid.*, No. 19, p. 361.

[3] *Ibid.*, No. 33, p. 641.

[4] "Des Antiseptiques locaux dans le Traitement de la Syphilis." *La France médicale*, Oct. 3, 1889, p. 1362, *et seq.*

[5] "Du Traitement des Plaques Muqueuses Hypertrophiques persistentes chez la femme," *Thèse de Paris*, 1888.

lightly several times over the surface. If the burning is too severe, trouble in healing will be experienced and annoying cicatrices will be produced. The patient should be under the influence of an anæsthetic, or cocaine should be applied to the lesions and also injected in close proximity to them.

Should chromic acid be used, the operator must remember that he has a very treacherous remedy, which may seemingly not penetrate deeply, and yet may lead to much destruction of tissue, and suffering.

The tincture of chloride of iron may often be used with comfort and benefit in these cases. The officinal tincture of iodine and a preparation of double strength are also very serviceable in some of the less pronounced cases.

Pustular, Encrusted, and Serpiginous Syphilides.—The early and intermediate pustular syphilides require sublimate, mercurial vapor, and sulphur and alkaline baths. Then the patient's body should be rubbed with mercurial ointment or a strong white precipitate ointment. About the face it is imperative that these lesions should be efficiently acted upon, in order to cause their prompt disappearance and to prevent cicatrices. For this purpose the following ointments may be used:

℞. Zinci oxidi,
Pulv. amyli, āā ʒij;
Unguent. hydrargyri (freshly prepared),
Vaselini, āā ℥ss.—M.

℞. Hydrargyri ammoniati, gr. xxx;
Zinci oxidi,
Pulv. amyli, āā ʒij;
Vaselini, ℥ss.—M.

Resorcin, 1 drachm, may be substituted for the white precipitate in cases in which there is a seborrhoic complication.

The encrusted syphilides require the use of baths and fomentations for the removal of crusts, and then calomel or iodoform may be dusted upon the raw surfaces, which should be covered with absorbent gauze. When these surfaces are extensive iodoform should be used sparingly, lest it produce a toxic effect, or it may be mixed with an equal quantity of subnitrate of bismuth and then applied more freely.

The serpiginous syphilide is sometimes very obstinate in its course, ordinary treatment failing to prevent its extension. Under these circumstances free but careful curetting, after removal of crusts and disinfection, as found beneficial by Spillmann[1] in five cases, may prove remarkably efficient. I have seen one such application promptly cause

[1] *Progrès médical*, Sept. 5, 1885.

the healing of a case which had been rebellious for many months. A similar procedure may be beneficial in some cases of extensive rupia after the removal of the crusts and the laying bare of a well-marked fungating surface. Some raw surfaces left by ulcerating syphilides show a tendency to exuberant fungating growths. When not sufficiently well marked to require the curette, they may be carefully touched with carbolic or nitric acid, after the manner laid down for the treatment of chancre.

Gummatous Syphilides.—The early or precocious gummata indicate the necessity for the use of the mixed treatment, or of iodide of potassium in combination with mercury applied locally. Daily inunctions should be made, and mercurial ointment spread on lint should be bound upon the parts. If much pain is present belladonna ointment may be mixed with the mercurial ointment.

In their non-ulcerated state late gummata may be treated in the manner just now described. When ulceration is active it may be necessary in some cases to scrape away the base and the margin. The necrotic membrane which is so commonly seen in these ulcers should be treated with compresses of sublimate solution (1 to 500, 1000, or 2000), or with compresses of carbolic-acid water (5 per cent.). The application of carbolic acid or nitric acid may be necessary. When the slough or membrane on the surface of the sore is not very dense or adherent, iodoform may be dusted upon it. When a raw surface has been exposed the application of a mild mercurial ointment with the addition of some balsam of Peru (1 drachm to the ounce) will usually cause prompt healing. In very large and deep gummatous ulcers, after dusting with iodoform, sterilized sand may be freely packed in and retained by absorbent gauze and bandage.

Tubercular Syphilides.—These, when of the non-ulcerative variety, should be treated in the manner indicated for papular syphilides. Being late and deep lesions, they require the administration of both mercury and iodide of potassium. To cause their involution mercurial baths and sublimate baths may be employed. Each tubercle should receive very vigorous friction with mercurial ointment, which when practicable should be kept in constant contact with the lesion. In some cases mercurial plasters may be very efficacious. Scaling conditions of the skin left by this syphilide require a similar treatment to that of the scaling sequelæ of the papular syphilides.

Treatment of Affections of the Hair.—In the early months of syphilis the hair may fall out in numerous large or small patches, or there may be a general thinning of the hair over the whole scalp. It is very important that local treatment should be promptly instituted. If possible, the hair should be cut short at once; then the scalp should be thoroughly cleansed and moistened twice a day with a solution of subli-

mate (1 to 1000). If any erythematous papular or pustular lesions are present, calomel or white precipitate ointment may be rubbed into the skin once a day. When there is a seborrhœal complication, the following ointment will prove beneficial:

℞. Resorcin., ʒj;
Balsam. Peruvian., ʒj;
Vaselini, ℥j.—M.

As a stimulant to the scalp, for use every night, the following prescription will prove valuable:

℞. Tinct. cantharid., ℥j;
Tinct. capsici, ʒss;
Aquæ cologniensis, ʒij;
Aquæ, ℥iv.—M.

To be well rubbed into the scalp by means of a sponge.

In very obstinate cases stimulation of successive patches by the application of pure liquid carbolic acid or of cantharidal collodion may be tried. The nutrition of the patient must be improved as much as possible, and tonics must be given with the internal mercurial remedy.

Treatment of Affections of the Mouth.—It is well to repeat here what has already been said—namely, that continuous care must be exercised regarding the condition of the mouth, particularly in the first year of syphilis. Excoriations of the tongue may be touched with a solution of nitrate of silver (10 grains to the ounce), and the mouth rinsed with a solution of chlorate of potassium, of borax, or of alum. In many cases the application of a solution of chromic acid (from 10 to 30 grains to the ounce) will heal some patches. Mucous patches of the cavity of the mouth and pharynx may be sprayed every few days with a solution of nitrate of silver (20 grains to the ounce), and the mouth rinsed frequently with Dobell's solution or with the following gargles:

℞. Sodii borat., ʒiij;
Tinct. catechu,
Tinct. myrrhæ, āā. ℥ss;
Aquæ, ℥vij.—M.

℞. Argenti nitrat., gr. xxiv;
Listerine,
Glycerini, āā. ℥ss;
Aquæ, ℥vij.—M.

℞. Hydrargyri chlorid. corros., gr. ij to viij;
Tinct. myrrhæ, ℥ss;
Aquæ, ℥viiss.—M.

This sublimate gargle is very efficient in its action. It may be used in a mild form for ordinary cases, but those attended with severe symptoms require the strong solution. When the latter is used patients should be warned not to swallow any of it. Recently black wash has been highly extolled by Dr. C. H. Griffin[1] as a gargle for mucous patches and syphilitic ulcerations of the throat. In the few cases in which I have tried it private patients have complained that it was nauseous to them. At the Vanderbilt clinic we have found its action beneficial.

A treatment said to be new, but really a modification of the old-time Corbel-Lagneau mercurial pastilles, has recently been recommended by Crequy.[2] The formula of these pastilles is as follows:

℞. Hydrarg. iodidi virid., gr. ¾;
Potassii chlorat., gr. iij;
Potassii iodidi, gr. ¾;
Chocolatæ, q. s.—M.
Ft. in tabellam No. I.

One or two such tablets a day may be allowed to dissolve in the mouth.

Gummy infiltration into the the soft or hard palate or into the pharyngeal walls requires the prompt institution of a strong mixed treatment, or the employment of friction upon the neck and the ingestion of full doses of iodide of potassium. Beginning with 10 or 15 grains three times a day, the dose should be increased 5 to 10 grains every day. Prompt active treatment will frequently arrest the morbid process, and thus spare much destruction of important tissue. Locally, solutions of nitrate of silver by spray may be used, and if there is an ulcerated surface, iodoform by insufflation or in suspension in glycerin should be used. In many cases the strong bichloride gargle will prove beneficial. It is well to remember the old Ricord gargle, composed of iodide of potassium, tincture of iodine, and water, for it is often very beneficial.

Treatment of Affections of the Nervous System.—The early supervention of symptoms referable to the cerebro-spinal system in many instances necessitates the precocious use of the iodide of potassium. Syphilitic headaches will frequently be found to be very persistent and rebellious to treatment when mercury is given by the

[1] *Medical Record*, Sept. 22, 1891.
[2] *L'Union médicale*, 1891; and *Medical News*, April 24th, 1891.

mouth. I have seen in consultation many such instances, where the use of pills has been pushed to the extreme of intense salivation, and yet the nocturnal headaches persisted. In some few cases calomel, in doses of $\frac{1}{5}$ or $\frac{1}{4}$ grain every three or four hours, may prove beneficial, but the danger of salivation is always to be feared if its use is at all prolonged. Mercurial inunctions into the neck and temples will usually prove very beneficial, and synchronously iodide of potassium in increasing doses should be given.

Any affection of the cerebro-spinal system occurring in the early years of syphilis should be treated by mercury, either administered by inunctions, made as near the head as possible, or by hypodermic injections, two or three of which may be given in the neck. At the same time iodide of potassium should be given internally. This remedy may be taken in milk, in Vichy water, and in cases of weak stomach may be combined with Fairchild's essence of pepsin, and also with bitter tonics. In some cases a dose of 30 grains three or four times a day will have the desired effect. In obstinate cases, however, the remedy must be pushed with a free hand until amelioration in the condition is produced or the obstinacy of the case shows that such disorganization has been produced by the syphilitic process that further improvement is hopeless. As much as 1 ounce or $1\frac{1}{2}$ ounces have been required in many cases to produce a cure. I am, however, firmly of the conviction that when mercury is synchronously administered, as it certainly should be even in advanced cases, it will seldom be necessary to push the iodide as heroically as has been done in the past.

Besides the essential treatment here succinctly outlined, much treatment directed to concomitant and consecutive symptoms and conditions will be required, and should be instituted according to the indications presented.

Treatment of Gingivitis, Stomatitis, and Salivation.—A patient under mercurial treatment should be, as before stated, carefully watched as to the condition of his mouth, throat, and nose. When there is any tendency to hyperæmia of the mouth and throat, free gargling three or four times a day with solutions of chlorate of potassium and alum, of common salt, or of borax should be used. When patients are undergoing an inunction cure, particularly, it is well to wash the mouth three or four times a day with strong alum-water or with a solution of alum and acetate of lead, as follows:

℞. Pulv. aluminis,	ʒiij;
Plumbi acetatis,	ʒss;
Aquæ,	℥viiss.—M.

The first signs of irritation of the gums should cause a diminution of

dose or a suspension of treatment and the adoption of local therapeutics. In any and all cases of mercurial action upon the mouth the physician should be very conservative in the use of caustic applications. For mild cases of gingivitis the application by a brush of equal parts of tincture of myrrh and tincture of iodine once a day, followed by some mild mouth-wash, will usually be all-sufficient. When the case is severe, and the tissues of the mouth and throat are very much inflamed and swollen, frequent rinsings with very warm solutions of borax and alum to which listerine and glycerin are added are very soothing. Once or twice a day it may be necessary to use as a mouth-wash and gargle a solution of the nitrate of silver (4 to 8 grains to the ounce). Much benefit often follows rinsing the mouth with a solution of bichloride of mercury. For this purpose Von Swieten's solution, either in its purity or diluted, will prove very efficacious. It is thought by Galippe, Renzie, and others that much of the intensity of the mouth-inflammation in mercurial poisoning is due to the activity of microbes, which are so numerous in the mouth, and that by its antiseptic action the bichloride is very efficient in these conditions. Patients thus suffering should be well nourished by means of nutritious broths and sarco-peptones, and should take quinine freely. They should be kept in the fresh air as much as possible. Much benefit and comfort may be derived from the application of a solution of cocaine to ulcerated surfaces. The judicious use of hot baths will aid in the elimination of the mercury from the system.

Treatment of Hereditary Syphilis.

Though the treatment of hereditary syphilis is very similar in many particulars to that of the acquired disease, it presents many divergencies and difficulties, and is not followed by such uniformly good results as are obtained in adults. Children born syphilitic are in various degrees tainted through and through with the poison, consequently the physician is at the outset brought face to face with malnutrition and a tendency to decay. He really has little, if anything, to build upon. In this fact lies the great difficulty in treating the victims of hereditary syphilis, and to it largely are due the many failures of our therapeutics. In acquired syphilis, as a rule, the evolution is tolerably orderly, and the lesions as they appear give indications which guide us in their cure. In hereditary syphilis, however, there is no order, and many of its manifestations are wrapped in obscurity and doubt. Thus it may be that we find bone and articular lesions present, with those of an exanthematic character seated on the skin. In some cases no skin lesions are present, while affections of the mucous membrane may exist, and then be in a doubtful and masked form. In other cases the evolution of lesions and various affections is early and prompt, and their general

physiognomy may point to their nature. Then, again, in lesions equally precocious there may be no decided features. Consequently, doubt and uncertainty as to their simple or specific nature may exist. This remark applies to ill-defined early eruptions and to affections of the mouth and nose, which, though caused by syphilis, resemble simple affections.

Further, the evolution of hereditary manifestations may be much delayed, so that the suspicion of their specificity is forgotten or not entertained. Thus we may see delayed cutaneous and mucous eruptions which are atypical and cause much perplexity of mind.

As a rule, the treatment of acquired syphilis is progressively orderly, while that of the hereditary disease is very often begun in doubt and uncertainty, and throughout its course subject to all manner of changes and modifications. A condition requiring mercury to-day may be replaced by the necessity to use iodide of potassium within a week, and *vice versâ*. Consequently, no specific data can be laid down for a general methodical treatment of hereditary syphilis. It is incumbent, therefore, upon the physician to watch his case continuously, and always to be ready with such measures of relief as may be indicated by the existing lesions.

It must be clearly understood by the physician, and as clearly presented to the parents or guardian, that, as a rule, at least one year and more—generally two—are necessary for the treatment of a syphilitic infant. The disappearance of one crop of manifestations merely means that one stage of the disease has been auspiciously passed over. We must then keep on in order to prevent or attenuate the severity of later outbursts. It is always well, however, to temper the activity of treatment by proper intermissions.

We will first consider the question of the treatment of the pregnant syphilitic mother; then the expediency of treating the child through the medium of a medicated mother or nurse; and then we shall come to the subject proper—namely, the treatment of hereditary syphilis in its various forms.

The Treatment of the Pregnant Syphilitic Mother and its Effect on the Fœtus.—An important question in the therapeutics of hereditary syphilis is the management of the case of the pregnant mother. On this subject the views of the profession are far from being clear and sharply formulated, and while we find some who recommend that the mother should be treated on her own account and also as a prophylactic measure for her offspring, others are in a state of doubt as to the wisdom and probable beneficial outcome of such a course, having an ill-defined fear that harm may thereby come to both. It is necessary, therefore, that this question should be studied in the light of the accumulated knowledge of to-day.

When it is possible the physician should endeavor to prevent the marriage of a syphilitic, male or female, until he or she shall have had a well-regulated general methodical treatment for at least two or two and a half years. At the end of that time, if their condition warrants it, they may marry. Some authors plead for a longer period of time, but I am fully convinced that in favorable cases treatment followed on the lines indicated will fit patients to marry and to produce healthy offspring. I have seen scores of infants born under these circumstances who have been healthy and strong. In very many cases, however, syphilitics will marry in spite of the physician's remonstrance, and a vast number marry who either do not know or do not realize the gravity and danger of their position. So that whatever the profession may do in trying to prevent the procreation of syphilitic children, these weakly and miserable specimens of humanity will come into the world, and their treatment during their gestation and after birth will be a source of solicitude and a tax upon the therapeutic resources of the medical profession.

In this connection let us briefly consider what is the effect of hereditary syphilis upon its victims. And to this end I can do no better than quote the carefully-prepared statistics of Fournier.[1] In his personal experience this observer found that in private practice more than two out of three hereditary syphilitic children died, either before, at, or soon after birth. In hospital practice Fournier found that out of 167 children born of syphilitic mothers, 145 died; which means that 1 child out of 7 or 8 survived. It having been claimed that Fournier's personal statistics made an exceptionally bad showing, and that they were exaggerated, he collected those from the whole world, his own excepted. He gathered the histories of 447 cases of children whose fathers or mothers were syphilitic, and found that out of this number there were 343 deaths, there being only 104 who survived. Of the 343 children who died, only 6 lived beyond the first year. The proportion of living children, according to these statistics, is 1 to 4.3.

The resources of the medical art certainly should be taxed to the utmost to reduce such an appalling death-rate.

Before proceeding to the question of the treatment of sypyilitic mothers, it is important to consider the part of the father as a factor in the causation of hereditary syphilis. It is now well known that men in the grasp of active syphilis very frequently procreate infected children whose mothers, unless infected by some active lesion, may remain free from the disease. Therefore it is the duty of the physician to explain to a syphilitic father that his disease is liable to infect his offspring, and to urge him to avail himself of all possible measures to rid himself of it.

[1] *La Syphilis héréditaire tardive*, Paris, 1886, p. 160, *et seq.*

The necessity of treating a syphilitic mother being therefore so obvious, the question arises, Can we treat such a mother without danger to herself, and will that treatment be beneficial to her and to her offspring? So many facts have been accumulated by so many observers in medical literature—notably, Massa, Garnier, De Blégny, Astruc, Petit, Fabre, Levret, Rosen, Underwood, Swediaur, Bell, Bertin, S. Cooper, Lagneau, Gibert, Cazenave, Cullerier, and Ricord—as to the wisdom and benefit to be derived both by mother and child from a well-ordered antisyphilitic course of treatment during pregnancy that I will answer the question and its subdivision emphatically in the affirmative. I know of no condition in the course of syphilis which more urgently demands an active and energetic but careful, watchful, and conservative treatment than does pregnancy in a syphilitic woman. Huguier and others thought that mercurial treatment predisposes a woman to more serious danger in abortion than if a simple treatment had been followed. Indeed, the idea was and is prevalent that mercury will produce abortion in pregnant women. If carelessly and unsparingly used, it may undoubtedly produce abortion and imperil a woman's life. But if the treatment is followed on the lines indicated in this article, no harm will be done and infinite good will certainly result. I am fully in accord with Sigmund,[1] who says that there is not the slightest danger to the mother or child by the use of a careful inunction treatment. By this means he has seen (and I can confirm his statement) living and healthy children brought into the world. As corroborative evidence I may here give Ricord's views, which, though old, are very apposite. He says: "The period of gestation in women, far from contraindicating energetic treatment, demands increased attention and promptitude within the bounds of prudence. I have seen very many more abortions among syphilitic women who had not been treated than among those who, taken in time, had been subjected to methodical medication."

A question so vitally important as the present one should be treated in the light of accomplished facts, and something more than mere statements should be offered. It is interesting, therefore, to know that the effect of mercurial treatment upon the pregnant syphilitic woman has been carefully and extensively studied under Sigmund's guidance and in his wards by Löwy[2] and Fonberg.[3] Löwy's observations go to show that by treating pregnant syphilitic women by inunctions abortion was reduced to 13.5 per cent., while in those not treated the ratio was

[1] *Die Einreibungs-cur mit grauen Quecksilbersalbe bei Syphilisformen*, Vienna, 1878, p. 103, *et seq.*

[2] "Beobachtungen an einen Reihe von Syphilitischen Schwangeren Welche der Einreibungs-cur unterzogen Werden." *Wiener med. Wochenschrift*, No. 39, 1869.

[3] "Statische Daten ueber Syphilis der Schwangeren mit Rücksicht auf Heredität und Behandlung," *Ibid.*, Nos. 49, 50, and 51, 1872.

29.5 per cent. After inunctions there were 75 per cent. of living children. His observations further prove that the treatment exerts no bad influence over the life of the mother and of the fœtus, and that it does not cause abortion or premature labor, and further, that it lessens the severity of the disease in both. In like manner, Fonberg found that the inunction treatment reduced the number of abortions from 28.5 to 14 per cent. He very wisely adds that a too energetic treatment may be injurious to mother and child.

Clinical observation has the support of a fact derived from careful chemical analysis. Cathelineau,[1] at Fournier's suggestion, made a careful analysis of the viscera of a fœtus whose mother was treated by inunctions. He found unmistakable evidence of mercury in the liver, heart, kidneys, and other organs as well as in the amniotic fluid.

These conclusions, the outcome of careful and extended observation and study, supported by the testimony of the observers mentioned, certainly should be accepted, and thus humane and beneficent medication should be administered to the pregnant woman.

Pregnancy, therefore, is an exigency in which, as shown on p. 36, the very early administration of antisyphilitic treatment is indicated. The management of syphilis in the pregnant woman requires of the physician skill, care, and watchfulness. As soon as the chancre is diagnosticated it should be treated carefully and efficiently. Lesions of any kind on the genitals of the pregnant woman indicate the necessity for great cleanliness. This is especially necessary when chancre is present. Therefore frequent mild antiseptic injections and ablutions should be made to the parts, in order to avoid any complicating inflammatory conditions. Then mercurial ointment on cotton or lint should be applied continually to the chancre. Throughout the course of gestation this antisepsis of the external genitals should be regularly followed.

It is important that the physician should have an accurate knowledge of the effect of the various preparations of mercury upon the pregnant woman, in order that he may adopt a proper treatment. There is no fact in syphilography more deeply engraved upon my mind than that of the utter futility of treating a pregnant syphilitic woman, and of endeavoring to prevent or render more mild the disease in the child, by the use of mercurial pills. I can look back, ten to twenty years ago, to many cases in which mothers thus treated were not at all benefited, often much inconvenienced and troubled, and in which no effect upon the syphilis in the child was produced. Many failures with the proto-iodide in this direction convinced me of its feeble powers, and my clin-

[1] Passage du Mercure de la Mère au Fœtus dans le Traitement antisyphilitique fait pendant la Grossesse," *Bulletin de la Société Française de Dermat. et de Syphilographie*, 1890, vol. i. p. 167, *et seq.*

ical results find their explanation in the experiments of Welander.[1] This observer found that by mercurial inunctions and hypodermic injections the drug was rapidly absorbed by the mother and transmitted to the fœtus, but that when pills of the protoiodide were administered the absorption was very slow and the action very feeble, owing to the smallness in quantity of the mercury absorbed. Therefore, in general it is a waste of time to treat a syphilitic woman either by the protoiodide, by gray powder, blue pill, the tannate, or any other preparation which is swallowed in pill form. Further than this, disaster may follow such a course. Many a man has thus treated a pregnant syphilitic woman and innocently imagined that he was doing all in his power for her.

It is well, therefore, to institute a systematic inunction treatment with all the precautions and safeguards spoken of in the section upon this branch of the subject. No pains should be spared in watching the woman to learn that all goes well and that the therapeutic effect is being obtained. In this way course after course of inunction should be given, with proper intervals of rest, during the whole period of pregnancy. If the treatment is carefully administered and the general condition and surroundings of the woman are favorable, there will be no trouble in keeping on to the end.

In like manner, if admissable, hypodermic injections of sublimate will be found of especial benefit. They should be given for a week or two at a time, in the retro-trochanteric regions principally. One very great advantage of the inunction and of the injection methods is that the stomach—so prone to rebel—and the intestines are spared.

But it often happens that objections to these methods are offered, and that the condition of the patient will not permit of their employment. On the principle that half a loaf is better than no bread, the physician may sometimes compromise matters and have the patient take a few inunctions for a time or a few injections, and then fill in the balance of the time by medicine given internally. He should make it very clear to the patient that if she can possibly use the inunction or submit to the injections for short periods and at odd times, she will be much the gainer.

Internally, the mixture of mercury and iodide, the formula of which is to be found on p. 60, may be given if stomach ingestion is found to be the most acceptable method.

The foregoing considerations concern chiefly early and active syphilis, in which condition mercury is especially indicated. In the case of women in later periods of syphilis, who are either the subjects of repeated abortion or whose children show evidence of hereditary taint,

[1] "Récherches sur l'Absorption et sur l'Elimination du Mercure dans l'Organisme humain," *Annales de Dermat. et de Syphilographie*, 1886, p. 412, *et seq.*

iodide of potassium in good-sized and perhaps increasing doses, combined with mercury, should be given with proper intermissions during the whole pregnancy. Pregnant women in an advanced stage of syphilis are greatly benefited by the iodide alone, but particularly in combination with mercury. The embryos of these women of course have a more advanced form of syphilis, and these drugs given to the mother exert beneficial therapeutic effects upon the child she carries.

In this connection it is well to remember the teachings of the case of Moreau,[1] which was that of a woman who, after several successive pregnancies always ending in premature birth and death of the fœtus, in despair as to the cause was submitted to an active syphilitic treatment, and who thereafter gave birth to healthy children at term.

As claimed by Dubois, Depaul, Moreau, Vidal De Cassis, and Putégnat, parents who procreate syphilitic children, even though they themselves may appear healthy and show no signs of the disease, should undergo a regular, methodical antisyphilitic treatment.

Indirect Treatment by Means of the Milk of the Mother or of the Nurse.—As early as 1699, Garnier proposed to treat syphilitic children by means of the milk of the mother or nurse, to whom mercury was being administered. This method is called "the indirect way of treating hereditary syphilis," and it has and has had many advocates, and perhaps as many opponents. It is a subject which often arises in the practice of medicine, and one concerning which few physicians have definite ideas.

The adoption of this treatment was really the outcome of the difficulties experienced in administering antisyphilitic treatment to young infants. The older physicians not only treated the mother or the nurse, but in the case of the absence or defection of either of these parties they caused the hair to be shaved off a female goat or ass, had the animal well rubbed with mercurial ointment, and then the child was made to nurse it, and thus simultaneously get sustenance and medication. Swediaur says that in one of the reigning families of Europe no child survived a certain age until this treatment was adopted. Though benefit was noted in many cases as following this treatment, it was claimed by some that no mercury, or only an insignificantly insufficient quantity, was conveyed by the milk, and that the seeming improvement in the child's condition was due to the auspicious course of its disease. Leaving aside the older analyses of milk from mercurialized women and animals, in some of which it was stated that mercury was found, and in others that it did not exist, we come to those of a later date. Thus, Kahler[2] resorted to very delicate electro-

[1] Lancereaux, *Traité historique et pratique de la Syphilis*, Paris, 1873, p. 562.

[2] "Untersuchungen der Milch von Frauen während der Inunctionen," *Vierteljahr. für die Prak. Heilkunde*, vol. xxxii., 1875.

lytic analysis of the milk of women in whom mercury had been used so thoroughly that existing syphilitic lesions had been cured, yet no trace of mercury could be found. Still, he states that in certain cases in which no mercury was given to the children improvement followed their nursing a mother who was taking that agent by inunction. This fact has been observed over a long stretch of years, and I have seen many striking instances of it. On the other hand, Klink[1] of Warsaw, with the aid of Professor Tudakowski, submitted such milk to very delicate and elaborate tests, and found in that fluid a small but unmistakable quantity of mercury. In Klink's case also the child had derived benefit from the mercurialized milk. On this subject Welander[2] says: "I have only made three observations on the elimination of mercury by the milk. A woman who had taken only ninety pills of the protoiodide had mercury in the urine as well as in the milk. The urine of her child, which she nursed, and had received no other treatment whatever, also contained mercury. To a woman who had no mercury in the urine an injection of the bichloride was administered and five days after I found mercury in the urine of her child. In another case mercury was found in the urine of a child each time after six experiments with bichloride injections given to its mother. These facts are in accord with the results of many other investigators, and they seem to prove conclusively that mercury may be conveyed to the child by its mercurialized mother's milk." The evidence obtained through chemical analysis by many competent observers is in striking accord with the results of clinical observation, and the combined knowledge I think proves the benefit—never, however, absolute—of the mercurialized milk of a syphilitic mother.

In all probability other conditions besides the mercury contained in the milk are involved in the child's improvement. Undoubtedly, the syphilitic woman's health and nutrition are improved by the systematic inunction treatment which she receives, and as a consequence her milk is purer and more sustaining to the child than it would be without the treatment. She then gives a more competent milk, and dissolved in it is the remedy which the infant so sorely needs.

The practical deduction to be drawn from these facts, accumulated during a period of several hundred years, is that we should treat the syphilitic mother whenever we can, particularly by inunctions, not only for her own sake, but also for that of her child, for it benefits the one that receives and the one that gives.

We must not forget that in many cases syphilis is transmitted

[1] "Untersuchungen über des Nachweis der Quecksilber in der Frauenmilch während einer Einreibungscur mit grauer Salbe," *Vierteljahr. für Derm. und Syphilis*, 1876, p. 207, *et seq.*

[2] *Op. cit.*, p. 415.

directly from an infected father to his off-spring, and that the mother remains to all appearances free from the disease. The question, therefore, arises, What shall we do in the event of a non-syphilitic woman having a syphilitic child by paternal transmission? It will be found that some of these mothers are thin, sickly-looking women, while others are well-developed and robust. In these cases it has been my practice, when there was difficulty in administering mercurials to the child, to explain the condition of affairs to the mother, and with her consent (which is, as a rule, readily gained) to try a tentative course of treatment upon her. When inunctions cannot be used, hypodermic injections may be given or the mixed treatment may be taken. The question of utility and of benefit will be settled in a week or two.

We may conclude, therefore, that the indirect treatment of hereditary syphilis by mercury should not be regarded as one of the standard methods, but rather as a resource to fall back upon, or as an adjuvant to be instituted in cases in which it is admissible or seems to offer probabilities of benefit.

Indirect Administration of Iodide of Potassium to the Syphilitic Child by Means of the Milk of the Mother or Nurse.—Not only is mercury administered to the syphilitic child by means of the milk, but several authors have adopted this method of employing iodide of potassium as the therapeutic agent. La Bourdette and Dumesnil,[1] many years ago, showed by quantitative analysis the presence of iodine in the milk of animals to whom the iodide of potassium had been administered. This observation was later confirmed by Schafer,[2] who found iodine in the milk of a woman two hours after the ingestion of 15 grains of the iodide. These results were fully confirmed by a number of experimenters, among whom was Welander,[3] who observed an iodic coryza and iodic eruption in a nursing infant whose mother was taking fifteen grains of the iodide daily.

In clinical practice the indirect treatment with iodide of potassium does not possess a rich literature, but the reported results are certainly worthy of record and consideration. Lazansky[4] in Pick's clinic thus treated a four months' old child whose mother took 15 grains of the iodide daily. The eruption quickly left the child and the mother became healthier. Chemical analysis of the milk and of the infant's urine showed the presence of iodine. This observation is supported by

[1] "Du Passage de l'Iode par Assimilation digestive dans le Lait de quelques Mammifères," *Gazette des Hôpitaux*, 1856.

[2] "Aufsugung und Ausscheidung der ollic. Iodpraeparate," *Zeitschrift der Wiener Aertze*, 1859, No. 5.

[3] *Nordiskt Medicinskt Archiv*, t. vi., v. 31, 1874.

[4] "Ueber die therapeutische Verwendung von iodhältiger Ammenmilch," *Viertel-jahr. für Derm. und Syphilis*, 1878, p. 43, *et seq.*

the results obtained by Link,[1] who thus treated four cases in Ganghofer's clinic in Prague. In the first case, a child ten weeks old, having snuffles, general exanthem, and ulcers, was promptly benefited and cured of its visible lesions in thirty-three days. In the second case, a four-months' old girl, with exanthematic symptoms, and bad diarrhœa, was relieved of her existing lesions in five weeks. The third case was that of a premature girl, who two days after birth had a general exanthematic condition. During the ensuing fourteen days, in which the mother took 30 grains of the iodide daily, the child increased in weight, and its rash slowly vanished. In the fourth case, a child at nine weeks presented active symptoms of hereditary syphilis. For two weeks it was treated non-specifically and then it was subjected to the indirect treatment. At the end of five weeks its health and weight were improved and its rash had disappeared. Link thinks these results very gratifying, for the reason that the disease was active in the infants, and was accompanied with such complications as diarrhœa and stomatitis.

It is claimed by Stumpf[2] and others, on theoretical grounds, that the use of iodide of potassium in such cases is contraindicated, for the reason that it tends to diminish the quantity of the milk and to induce atrophy of the mammary glands. It is very probable that a prolonged course of the iodide will produce the effects claimed to result from this drug, but such will rarely be necessary in practice. This treatment, if it is adopted by any one, need not of necessity be very long continued, but its effects on mother and child should be carefully watched. If beneficial it may be used until the child is far enough along to do without treatment for some time or until it can bear direct treatment. Contraindicating conditions should cause its prompt rejection.

The indirect treatment of hereditary syphilis by means of the iodide is therefore a measure of reserve and utility, to be employed only in some cases when other methods are impracticable or temporarily contraindicated.

As in the section on the General Methodical Treatment of Syphilis I take the ground that in most cases iodide of potassium is powerless, and often harmful, it may seem inconsistent for me thus in a measure to recommend this drug for women and children. But it is well to remember that in some cases there seem to be two conditions to treat—namely, the essential syphilis and the symptoms—which are explainable only on the theory advanced by Finger,[3] that in addition to the syphilitic virus the system is poisoned by ptomaïnes or

[1] "Ueber die Behandlung der Syphilis bei Säuglingen," *Prager med. Wochenschrift*, 1883, p. 305, *et seq.*

[2] "Ueber die Veränderungen der Milchsecretion unter dem Einflusse eineger Medicamente," *Deutsches Archiv für klin. Med.*, vol. xxx., 1881 and 1882, p. 201, *et seq.*

[3] "Die Syphilis als Infectionskrankheit vom Stand-Punkte der modernen Bacteriologie," *Archiv. für Derm. und Syphilis*, 1890, pp. 340, 341.

tissue-products which result from the action of the virus. Besides the symptoms already mentioned as being probably caused by tissue-products, it seems very probable, judging from clinical observation, that in pregnant syphilitic women and their children these morbid secretions are very often active and potent. At any rate, the theory seems rational, and it is an undisputed fact that in some of these cases the iodide acts favorably.

It is also necessary to emphasize the fact that the mixed treatment, either with an excess of the iodide or of mercury, is, as said before, very often a most valuable agent in the treatment of pregnant syphilitic women. Useful and efficacious before childbirth, it is also in some cases beneficial to the mother and also to the child. The indirect method, employing the mixed treatment, should be remembered by physicians in the category of inunctions and of iodide of potassium.

The Treatment of the Syphilitic Infant.—The treatment of the syphilitic infant is in many cases a question which necessitates great delicacy, tact, and prudence on the part of the physician, and in every case a good knowledge of the disease, of medicine in general, and of therapeutics is required. The subject can best be presented by a consideration of the condition of the infant from its birth onward. The first question to settle is when to begin to treat the child. So eminent an authority as Archambault[1] thinks that the offspring of a known syphilitic father or mother should be put upon treatment at once, even if it appears healthy and presents no visible syphilitic lesions. Should such a child present any evidence of cachexia, the prompt adoption of treatment is imperative. However, as it is not very uncommon for a syphilitic woman to beget, or a syphilitic father to procreate, a seemingly healthy child, which as it grows up may show no evidence of hereditary infection, it is always well, if medication is commenced very early, that it should not be too active or energetic. A baby may be puny at birth and not be syphilitic, but it is fair to assume that a puny baby whose father or mother is syphilitic is so far syphilitic itself that it needs the intervention of rational treatment.

It may be stated as a general rule that syphilitic infants who have a chance, even slender, for their life come into the world with little or no sign of their inheritance upon them. Therefore for a time important objective phenomena are wanting. Then in many cases the physician can get no information, for the reason that the parents may forget that they have had syphilis or they (one or both) conceal the fact, or, again, they may be ignorant of the possibility and danger of hereditary transmission. In hospitals we frequently see women who give birth to

[1] "Traitement de la Syphilis infantile," *Journal de Médecine et Chirurgie pratiques*, June, 1878.

tainted children, but who can give no facts relating to the father from whom the disease had been derived. Then in infant and foundling asylums children in the very early latent period of syphilis are left for care, concerning whom no history whatever is obtainable. So that in private and in public practice the diagnosis of hereditary syphilis in the new-born is commonly very difficult, and ready knowledge and acumen on the part of the physician are very essential.

In private practice, in many cases where no data are volunteered by either father or mother as to their condition before the birth of the infant or as to the probable cause of or source of its disease, the physician's position is very delicate, and sometimes very trying. Under these circumstances, he should act with great prudence and tact, keeping his own counsel, but he should at once place the child upon proper treatment, and then await developments. Generally, the child's illness will cause the father or the mother to think of his or her previous condition, and then a ray of light may be shed. As a general rule, in this complication of affairs the physician had better, if necessary, approach the father on the subject of the child's disease, since he commonly will be found to be the guilty person, or his past history will be such that a suspicion of syphilis derived from him will not greatly shock or surprise him. In general, he will do very little in the way of recrimination of his wife, and will prefer to keep silent.

Before considering general methodical treatment, something should be said concerning the management of young infants and children thus infected. First, as to the nourishment. If possible, the child should be nursed by its mother, who should be subjected to proper treatment, and placed in such a condition that she can supply nutritious milk. If the mother cannot suckle her child, it must be put upon cow's milk properly sterilized, and care must be taken to sustain its nutrition in every possible way. In no instance should a syphilitic child be put to the breast of a healthy woman. Though Diday has long advised and sanctioned such a course, the condemnation of it by all other authors is unanimous. On this subject I can with advantage quote the words of Grassi[1] on the responsibility of the physician concerning the employment of a wet-nurse for a syphilitic child. He says: "It is the peremptory duty of the parents to inform the wet-nurse of the danger she is exposing herself to. This is especially the duty of the physician, as there are cases on record in which such wet-nurses have infected their husbands, their children, and other persons in their neighborhood. But even if a wet-nurse knowingly contracted for such service in consideration of large pay, it would be the duty of the physician to prevent

[1] "Un Appunto all' Articolo di Diday: Sulla Responsibilita del Medico verso il neonato e verso la Nutrice," *Giornale Italiano delle Malattie Ven. e delle Pelle*, vol. ii., 1868, p. 233, *et seq.*

this, for individual liberty must be restricted as soon as others suffer from it: *Salus publica suprema lex esto.*" Fournier has also spoken emphatically in the same vein. If possible, a well-nourished syphilitic wet-nurse should be obtained. This is usually a less difficult task than might be supposed, for syphilitic mothers can usually be found in infant asylums and in large public hospitals. In some rare cases, for various reasons, the urgency is very great, and parents are willing to make any sacrifice to save their child. On this subject Steiner[1] says "that a syphilitic child should not be given to a wet-nurse. I must, however, confess that there are exceptions to the rule. I myself have been obliged to allow this in certain cases where life could only be preserved by the employment of a wet-nurse. *But I never do this without informing the nurse of the danger she is likely to expose herself to.* If, thus warned, she is prepared to undergo the risk, I have at least done my duty as a man and as a physician." The foregoing so clearly brings out the necessities and duties in these cases that nothing remains to be added.

On the Continent the practice of suckling syphilitic children by means of a she-goat or she-ass has been in vogue from an early date, but it has not, to my knowledge, been employed in this country. In a recent brochure Bellaserra[2] strongly advocates the use of animals in nursing syphilitic infants, and he makes the suggestion that she-goats and she-asses should be kept ready for such use at maternity hospitals and at infant asylums. If this method is adopted in any case, due care must be taken that the quantity and quality of the milk shall be in keeping with that of the human female.

The general hygiene of the child should be upon as high a plane as possible. Hereditary syphilis, being accompanied with atrophy, wasting, and many debilitating influences, requires more than any other infantile disease every possible healthy surrounding and aid. Then stress should be laid upon the actual care of the infant. The physician should endeavor to bring intelligent antisepsis to its aid in every possible direction. The mouth, tongue, and nose should receive attention, and for this purpose there is nothing better than a solution of boric acid (10 to 20 grains to the ounce). With this the nose, if snuffles are present, may be gently irrigated, and the mouth carefully washed three or four times a day. Great care should be exercised to prevent septic infection. The tissues of the young child, particularly when it is syphilitic, are very vulnerable to the inroads of pyogenic and septic cocci, which luxuriate in them. These gain access to

[1] "Zur Behandlung der Hereditären Syphilis," *Oesterr Jahrbuch für Pädiatrik*, 1870, N. F. 1, p. 95, *et seq.*

[2] "Prophylaxia de la Sifilis en el Niño y en la nodeyza por Medio de la lactencia Animal, particularmente en las Matermidades y Casas de expósitos," *Revista de Ciencias Medicas de Barcelona*, 1887, 5, p. 129, *et seq.*

the system through the skin and mucous membrane, also through the intestines, and probably through the lungs. Therefore, great care should be taken to heal up quickly any fissure, abrasion, or cut surface. Thus any lesion about the scalp, face, mouth, eyes, and anus or on any part of the body should be looked upon as a source of danger, and promptly healed. In very early days the navel should be carefully watched and kept in an aseptic condition by irrigations of carbolic-acid water, followed by drying and dusting with powdered boric acid or some other absorbent powder. Then further, the anus and its folds should be looked after. Attention to the alimentary canal may perhaps restore that to a satisfactory condition, and thus rid the child of a serious source of danger.

As before stated, in most cases of hereditary syphilis in which the child is born alive there may be no evidence of its disease at birth or for some time after. But in some cases soon after birth syphilitic lesions are seen in the infant. The most precocious evidence of hereditary syphilis is the bullous eruption, and it is always the expression of profound systemic poisoning. I may briefly state that this syphilide occurs most commonly and most typically upon the palms and soles as vesicles and bullæ which soon become purulent. They may appear about the buttocks, along the folds of the groin, or about the face and neck. There is usually a concomitant cachexia, or even marasmus, and the general skin is of a dull red, even violaceous, hue. In many cases snuffles and excoriations in the mouth are also present, and perhaps other evidences of syphilis. It is well to warn young practitioners that there is a simple form of pemphigus of the very young infant, and that great care in diagnosis is necessary. While, in general, infants presenting syphilitic pemphigus die within a few days, in some instances they may live. I have seen two such cases, and Neumann speaks of seeing one. This eruption brings up the question of the very earliest treatment of hereditary syphilis. For very young infants, as a rule, some mercurial salt in powder form, internally administered, is the one best borne and most commonly productive of good, if such is attainable. For this purpose many prefer calomel, and they administer it in doses of $\frac{1}{8}$ to $\frac{1}{3}$ grain three times daily for very young children. It is well to give a small dose to a very weakly child, and then to increase it as fast as possible. For well-nourished infants $\frac{1}{3}$ or $\frac{1}{2}$ grain may be given three times daily. Calomel can be rubbed up with a little sugar of milk, and the powder placed on the child's tongue before it is put to the breast. In case of diarrhœa, colic, or sleeplessness, a little Dover's powder may be added to the mercurial preparation which is to be used. When it is possible to administer them, adjuvant tonics should be combined with the mercurial. For this purpose the saccharated carbonate of iron is much praised by Stei-

ner and other authorities in children's diseases. It is palatable and well borne by the stomach, and may often be employed with marked benefit, particularly in children who have reached their third or fourth month. Many years ago Monti[1] proposed the saccharated iodide of iron in the treament of syphilis, either with or without the addition of calomel. It is a remedy which may be given with benefit when the child is six months or a year old, but considerable difficulty will be experienced in giving it to very young infants in whom it may also produce vomiting. Within a few years Monti[2] has proposed a combination of calomel and lactate of iron, which I have found of especial benefit in children three months and more old. The prescription is as follows:

℞. Hydrarg. chlor. mit.,	gr. iss;
Ferri lactatis,	gr. v;
Sacchari albi,	gr. xlv.—M.

Ft. in pulv. No. x.

From one to four of these powders may be given daily, according to the weight of the child.

Calomel may be given for a considerable time with benefit and without deranging the stomach and bowels. However, its action should be carefully watched, and if anæmia shows itself the calomel should be discontinued.

Following a course of calomel powders it is well to allow an interruption in the specific treatment, during which the saccharated carbonate of iron may be given or the saccharated iodide of iron, according to the formula of Monti, as follows:

℞. Ferri iodidi saccharat.,	gr. xv.
Sacchari albi,	gr. xxx.—M.

Ft. pulv. No. x.

One to three powders should be given daily, according to circumstances.

Gray powder (hydrargyrum cum cretâ) is also used by many. It is sometimes quite efficient in its action, and commonly it is less liable to produce gastro-intestinal reaction than any other mercurial. Its use is indicated in very weak infants with a tendency to great disturbance of the stomach and bowels. It is, however, not uniformly efficacious. It may be given in doses from $\frac{1}{8}$ to $\frac{1}{3}$ of a grain three times daily.

The protoiodide of mercury has been used in the treatment of hereditary syphilis with more or less benefit for many years. Bednar[3] used

[1] "Ueber die Behandlung der Augebornen Lues mit Ferri iod. Saccharat," *Journal für Kinderheilkunde*, 1876, vol. ix. p. 335, *et seq.*

[2] "Ueber ältere und Neuere Methoden der Behandlung der Augebornen Lues," *Archiv für Kinderheilkunde*, vol. vi., 1885.

[3] *Die Krankheiten der Neugebornen und Säuglingen*, Wien, 1853.

it largely in $\frac{1}{8}$- to $\frac{1}{4}$-grain doses, and considered it very efficient. Later experience has shown that in general these doses are too large, and are apt to be followed by bowel troubles and anæmia. Monti thinks that this salt is especially beneficial in the bone lesions of hereditary syphilis, and uses the following formula:

℞. Hydrarg. iodidi virid., gr. iss;
Ferri lactatis, gr. iij;
Sacchari albi, gr. xlv.—M.
Ft. in pulv. No. x.
One to three powders may be given daily.

In very young children it is well, if the protoiodide is used, to begin with the dose of $\frac{1}{20}$ grain, which may be increased according to indications. Though it is an active and efficient remedy, its use is commonly attended with colic and intestinal derangements, which necessitate the admixture of powdered opium or Dover's powder.

Henoch prefers the black oxide of mercury, according to the following formula:

℞. Hydrarg. oxid. nigri, gr. iss;
Sacchari albi, gr. xlv.—M.
Ft. pulv. No. x.
One powder morning and evening.

Monti has found this preparation less efficient than calomel.

The tannate of mercury is well thought of by some authorities, and it will be found to be very prompt in its action, and to cause syphilitic lesions to disappear rapidly. It may be given in doses of $\frac{1}{20}$ to $\frac{1}{8}$ grain three times daily, according to the age and weight of the child.

I have recently seen a mild and efficient action follow the use of the thymolate of mercury in two cases of hereditary syphilis, and I think that this preparation, as made by Merck & Co., should be borne in mind, for it is capable of producing good results.

In administering these mercurial powders the physician should always be on the watch as to their action and as to the condition of the little patient. In general, interrupted courses of a month or six weeks' duration should be followed, during which the child should have plenty of fresh air and every conceivable hygienic benefit.

By many authors corrosive sublimate is held in high esteem in the treatment of hereditary syphilis. It is used chiefly in the very early weeks of life and throughout the child's first year. If used, it is best given in Van Swieten's liquid in combination with a little milk. For very young children the dose of Van Sweiten's liquid is 5

to 10 drops two or three times a day, which is to be increased considerably for older children.

Thiry of Brussels recommends a solution of corrosive sublimate in emulsion of bitter almonds as preferable to any other preparation. There can be no doubt that some benefit may result from this mercurial salt when taken by the mouth in some cases, but in my judgment it is far inferior to the salts already mentioned, and cannot be compared for certainty of effect with inunctions. In whatever form given, corrosive sublimate is exceedingly liable to derange the stomach and bowels; hence it is at best a very uncertain remedy. Given subcutaneously, it is frequently very efficient. It may be well to remark that most of the authors who recommend this agent by the mouth add as a rider to their remarks that it may be necessary also to employ inunctions simultaneously, or give the child in addition baths of corrosive sublimate.

Iodide of potassium has a limited sphere in the treatment of hereditary syphilis. It may be of benefit in bone, joint, and cerebral affections and in lesions of the eye and ear. On this subject Steiner,[1] who made comparative studies of the treatment of syphilis by mercury, by iodine, and by the expectant plan, says: "From my experiments on children I am convinced that iodine, as well as mercury, causes the symptoms of hereditary syphilis to disappear, yet with the important difference that this happens more slowly under the administration of iodine than of mercury. Whatever improvement is attained in days with mercury is not accomplished in weeks with iodine."

As already stated, the limits of employment of the iodide are restricted, and its use in children as in adults is attended by more or less severe symptoms of iodism. In some children small doses produce prompt toxic effects, while in others saturation of the system may occur before untoward symptoms show themselves. The main symptoms of iodic derangement in children are—gastric and gastro-intestinal irritations, catarrh of the nasal mucous membrane, angina, headache, trembling, increased temperature, emaciation and weakness, and sometimes dermatitis of varying severity. These possible complications should be remembered by the physician. It should be mentioned that some physicians who recommend the iodide also state that it is well to combine its administration with inunction. Monti makes the significant remark that the iodide is only suitable for cases in which an energetic treatment is not indicated, or where sublimate baths are used.

The dose of the iodide for very young infants is from $\frac{1}{2}$ to 1 grain, well diluted, three times a day. For children of a year and older, 5 grains or more may be given three times daily.

The mixed treatment, however, is very efficient in many cases of hereditary syphilis, particularly of the bones and viscera, and in syphi-

[1] *Op. cit.*

litic subcutaneous tumors. My experience with the following formula, which I gave in my book[1] years ago, has been uniformly favorable in the cases in which a combination treatment is indicated:

℞. Hydrarg. chloridi corrosiv., gr. j–ij;
Potassii iodidi, ʒss;
Syrup. aurantii cort.,
Aquæ, āā. ʒij.—M.

For young children the dose is 5 to 10 drops (always well diluted) three times a day. This preparation is practically the same as Gibert's syrup, which is much employed by French physicians.

In addition to this treatment by the mouth, other methods of using mercury are employed in the treatment of hereditary syphilis. As a general rule, mercury by stomach ingestion is to be recommended for the first year of the child's life. As it grows older we can resort to mercurial inunctions. This method of treatment is as efficient for the infant and child as for the adult, and its administration to the former requires all the care and circumspection laid down as necessary for the latter. (See section on Inunctions.) There is a marked lack of unanimity of opinion in the minds of medical men as to the value and usefulness of inunctions in hereditary syphilis. Thus we find their use strongly deprecated by Widerhofer,[2] who says that they produce bad results, and that he has seen fatal bleeding from the ears and marasmus produced by them, while, on the other hand, Simon[3] and many others speak warmly in their praise. The truth is, that much benefit may be derived from their use, provided due caution and care are exercised. The inunctions should be given daily, using 15 or 20 grains of the strong mercurial ointment, going over the whole body after the plan already described. (See p. 86.) At the same time, the child should receive an iron tonic, and perhaps some cod-liver oil. Should signs of debility, restlessness, and sleeplessness, of weakness or anæmia, show themselves, the inunctions should be stopped at once. In some cases, particularly in children a year or more old, the local use of mercurial ointment or of mercurial plasters is productive of much benefit. The ointment may be spread upon canton flannel or buckskin, and bound around the child's body. By this means mercury is absorbed, and frequently benefit is noted, particularly in cases of enlarged liver or spleen. Mercurial inunctions and plasters are very effective in many cases of

[1] *Syphilitic Lesions of the Osseous System in Infants and Young Children*, New York, 1876.

[2] "Ueber Syphilis und deren Behandlung," *Allg. Wien. med. Zeitung*, 1886, Nos. 30 and 31.

[3] "De la Syphilis infantile congenitale: de son Traitement comparé avec celui de la Syphilis des Adultes," *Rev. mens. des Maladies de l'Enfance*, June, 1886, p. 245, *et seq.*

hereditary bone and joint disease. In intracranial syphilis, meningeal inflammation, gummy tumors, and hydrocephalus internus, this method, particularly when combined with iodide of potassium given internally, is often productive of surprising results. The quantity of mercurial ointment (50 per cent.) for each inunction is about 15 grains for a young child, and this quantity may be increased to 30 grains, provided there are no contraindicating conditions, and that improvement is noted. Elsenberg in a recent essay[1] advises full doses of the iodide internally, and the inunctions to be pushed until slight gingivitis or salivation is produced; then the dose should be diminished or the treatment temporarily stopped. It may be necessary and expedient thus to push this combination treatment, but it should only be done when the case is under the careful observation of the physician.

Widerhofer prefers an ointment of red precipitate (1 : 100 of lanolin) to mercurial ointment for children. About the head a white precipitate ointment (1 drachm to 1 ounce of vaseline) will be found of decided benefit, and in the case of infants with very fastidious parents this ointment may take the place of the blue ointment. White precipitate is readily absorbed by the adult or infant integument.

Hypodermic injections of mercurial preparations have long been used in the treatment of hereditary syphilis. Monti[2] was one of the first experimenters with this method, and he employed it in cases of intestinal troubles, of laryngitis, and where a quick result was necessary. His doses of the sublimate thus used were from $\frac{1}{32}$ to $\frac{1}{8}$ of a grain. In children under a year old the smallest dose is used; in those under five years of age $\frac{1}{24}$ of a grain; and in large, well-developed children $\frac{1}{16}$ of a grain may be injected. My colleague, Professor Jacobi, informs me that he has used these injections in very young infants and in older ones for many years in severe cases when a prompt and efficient action was necessary. He has seen benefit in very bad cases in children recently born. The resulting nodosities are said not to be painful, to cause little if any inconvenience, and to disappear promptly. I can well understand that in some private and hospital cases this method may be employed with signal success when the child is fully under the control of the physician. But it should always be employed with care and watchfulness. Monti, Smirnoff, and others advocate the use of calomel injections, while others, again, employ the albuminate, the peptonate, and other preparations of mercury. No preparation of mercury, however, is superior to the sublimate for this purpose.

This treatment will never, to my mind, be a success in dispensaries

[1] "Die Behandlung der Syphilis," *Wiener Klinik*, Aug. and Sept., 1891, p. 277, *et seq.*

[2] "Beobachtungen über die Behandlung der Syphilis congenita et acquisita mittelst subcutanen sublimat Injectionen," *Jahrb. für Kinderheilkunde*, 1869, 4 Heft.

and clinics. Moncorvo and Ferreira[1] in an out-door clinic of Rio Janeiro used gray oil, calomel, salicylate of mercury, and yellow oxide on forty-seven children from thirty-eight days to fourteen years old, taking the retro-trochanteric regions for the sites of injection. They found that the sublimate and gray oil were easily borne and most efficient. But we find at the end of nearly every clinical history these significant words: "Le malade ne revient plus au service," "nous avons perdu de vue cette fillete." In my experience in out-door services, as a rule, after hypodermic injections of mercurials patients submit to one or two, and perhaps more, and then they disappear.

Baths of corrosive sublimate are frequently of great benefit in the treatment of hereditary syphilis, and it is important that the physician should know their scope and their limitations. They should never be relied upon as a methodical treatment, though Cassel[2] claims that by the use of from twelve to thirty-six baths he has cured obstinate cases of bone-lesions, sometimes with the aid of calomel. These baths are particularly indicated in the cases of the bullous syphilide, of syphilitic roseola, of papular syphilides, condylomata about the genitals, and in cases in which there are complicating ulcerations. In some children with a thin, atrophic skin, icterus, and enlarged spleen they may produce benefit. The quantity, as stated by Elsenberg,[3] will be found to be beneficial. Thus 7½ to 30 grains of sublimate, according to the age and size of the child, with an equal quantity of chloride of ammonium, dissolved in a glass of hot water, should be added to 7 or 8 gallons of warm water. The child should stay in this from five to ten minutes, and then should be wrapped up warmly and put to bed. If erythema follows this treatment, the surface should be dusted with infant powder. But if the reaction is severe and persistent, it may be necessary to discontinue the baths. The suitability of the treatment may be ascertained after three or four baths. If the general condition of the child and its lesions are benefited, they may be kept up. But any signs of resulting depression, weakness, sleeplessness, and refusal of food should lead to their discontinuance. The baths may be given every second day, or perhaps every third or fourth day. Though some authors recommend this method of treatment for very young infants, as a rule it will be found of most service in children from one to three years old. Iodide-of-potassium baths have been used, but no one has claimed to have obtained conspicuously brilliant results.

[1] "Du Traitement de la Syphilis infantile par les Injections sousentanées de Sels mercurielles," *Revue mensuelle des Mal. de l'Enfance*, June and July, 1891.

[2] "Beiträge zur Hereditären Syphilis, besonders du Knockenerkrankungen bei desselben, *Archiv für Kinderheilkunde*, 1885, Bd. 6 p. 17, *et seq.*

[3] *Op. cit.*, pp. 244, 277.

Local applications to the lesions of hereditary syphilis are similar to those used in the acquired form of the disease. The ulcers and encrusted surfaces left by the bullous syphilide and other eruptions of an ulcerative character should first be washed with a 1 or 2 per cent. carbolic solution, and then dressed with the following:

℞. Zinci oxidi,
Pulv. amyli, āā ʒij;
Hydrarg. chloridi mite, ʒss–ʒj;
Vaselini, ℥ss.—M.

This ointment may be used for fissures about the mouth, nose, and anus. If a stimulant is admissible, 10 drops of carbolic acid may be added to each ounce of ointment.

White precipitate ointment and a combination of protoiodide of mercury and cold cream (10 to 20 grains to the ounce) may be useful in scaling papular eruptions, particularly of the palms and soles.

Rhinitis may be treated by the use of dilute Dobell's solution, injected slowly and carefully into the nostrils once or twice a day. This may be followed by the similar application of a solution of nitrate of silver (½ to 1 grain to the ounce of water). In some cases a mild solution of boric acid or of borax is beneficial in removing mucus and crusts. Mild solutions of nitrate of silver are necessary for mouth and lingual ulcerations. Condylomata lata of the genitals should be kept clean and dry, and should be dusted with a powder like the following:

℞. Hydrarg. chloridi mite, ʒiss;
Pulv. amyli, ℥j.—M.

If these lesions have become hypertrophic, they may be carefully touched with a solution of nitrate of silver (10 grains to the ounce), or with the ordinary acetic acid, or half-strength carbolic acid. When stimulating applications are made to these lesions, great care should be taken to prevent inflammatory reaction.

Bone, joint, and fascial lesions should be treated by plasters formed of strong mercurial ointment and Lassar's paste, of each equal quantities. In the management of hereditary ocular and aural affections, besides an energetic internal treatment, such local measures are necessary as may be indicated by the condition present.

In general, the treatment of acquired syphilis in infants and young children is the same as that given for the hereditary form of the disease. In acquired syphilis of the young the physician has less trouble, for he usually does not have the atrophic condition and the tendency to marasmus which are so common in the hereditary disease.

SCARLET FEVER, MEASLES, RÖTHELN, AND VARICELLA.

By J. LEWIS SMITH, M. D.

SCARLET FEVER.

Prophylaxis.

In order to determine how to prevent a disease the nature and mode of operation of its cause should be ascertained. This is especially true as regards the infectious maladies. The microbe which causes scarlet fever has not been positively ascertained, but the mode in which it is propagated has become known to a certain extent by clinical observation. Scarlet fever is contagious from the first day of its occurrence, and, if no disinfection be employed, its contagiousness probably does not cease as long as desquamation continues. The discharge from the ear following scarlet fever, due to otitis media, is believed by some to be infectious, even after the desquamative period is over, unless the ear be treated by antiseptic injections. If this be so, the contagiousness of scarlet fever is prolonged beyond that of most other infectious maladies.

The area of contagiousness of this disease is small, extending only a few feet from the patient. Hence in the asylums its spread is more certainly prevented by strict isolation of patients than is measles or pertussis, the specific principles of which are more diffusible in the atmosphere, and their area of contagiousness therefore considerably greater. The fixity or feeble diffusibility of the scarlatinous poison affords explanation of the fact that many children who are exposed, particularly if remotely exposed, do not contract the disease. Dr. Billington has stated that of 90 children in 26 families who were exposed to scarlet fever, 43 contracted it, while the remaining 47 escaped; whereas, as is well known, few children unprotected by a previous attack fail to contract pertussis, variola, varicella, or measles if exposed to either of these diseases. In the New York Foundling Asylum, during a series of years, children with scarlet fever were quarantined in a small room attached to one of the wards. The door between this room and the ward was permanently closed and the nurses of the scarlet-fever patients were strictly isolated. By these simple precautionary measures an outbreak of scarlet fever in this

institution was usually limited to a few cases, whereas the same precautionary measures employed in regard to measles and pertussis were ineffectual in preventing the spread of these diseases, which required isolation to a greater distance.

But this advantage in the small area of contagiousness of scarlet fever is more than counterbalanced by the remarkable tenacity with which the scarlatinous poison adheres to persons and objects, and its consequent portability from one locality to another. In its tenacious attachment to objects and its portability the scarlatinous virus surpasses that of any other eruptive fever except small-pox. I have never met a case in which there was even the suspicion that measles or pertussis was communicated by a third person or by an infected article, but scarlet fever is often communicated in this manner. In one instance that came under my notice a washerwoman, whose child had scarlet fever, communicated the disease to the infant in the household where she was employed by placing her shawl over the cradle in which it was lying.

In the New York *Medical Record*, August 4, 1888, the case of a servant-girl is related who nursed a child with scarlet fever in a distant city. She then packed in a trunk her effects, including the dress which she had worn when nursing the patient. The trunk brought from the distant city was opened one year subsequently in the presence of a girl of eight years, who handled the articles. This girl was soon afterward attacked with scarlet fever, and, as she had not been away from home and as there was no other case in the vicinity, there could be no reasonable doubt that the contents of the trunk, undisturbed for a year, had communicated the disease. A physician of my acquaintance called upon a family, stated that he had just come from a case of scarlet fever, and took one of the children upon his lap. This child soon came down with a fatal form of the disease, and the two remaining children also contracted it, one of them dying. In New York City, cases which I have observed render it highly probable that scarlet fever is often communicated through schoolbooks, which, illustrated by pictures and rendered attractive to the young, often lie on the bed of the scarlatinous patient, and are handled by him during his convalescence, or even during the disease if it be mild. The young librarian of the circulating library of a Sunday-school whose pupils came largely from the tenement-houses, spent one day in covering and arranging the books. After about the usual incubative period of scarlet fever he sickened with the disease. His two sisters were immediately removed to an inland town three hundred miles away, and to an isolated house where scarlet fever had never occurred. About one month after his recovery, the room which he occupied having been disinfected by burning sulphur, the bed-clothes and linen washed in boiling water, and all articles suspected of holding the poison either disinfected or destroyed, the

brother visited his sisters in the country. Soon after one of them sickened with scarlet fever, and a little later the other also. Two months elapsed after the last case, the room occupied in the country-house had been fumigated by burning sulphur from morning until evening, and the family had returned to New York, when a little girl from an inland city remained a few days in the house. She also soon after sickened with scarlet fever, which was fatal.

Similar cases might be related, showing that the scarlatinous poison adheres tenaciously to objects for many months, so as to produce the disease in those who are so unfortunate as to be exposed. The judicious regulations enforced by health boards have certainly had an effect in diminishing the prevalence of all contagious diseases, but cases such as I have detailed show the urgent need of additional prophylactic measures as regards scarlet fever; and the same is true of diphtheria.

It is the common practice, after the termination of a contagious disease, to disinfect the apartment vacated by the patient by burning sulphur, with the windows and doors closed. Is this the best that can be done? It is certain that it often fails to produce the desired effect. I have elsewhere stated that in the winter of 1887–88 diphtheria prevailed in the New York Infant Asylum, and that a ward in which five cases had occurred was vacated, its doors, windows, and crevices closed, and sulphur, 40 pounds, or 2 pounds to 100 cubic feet of air, was burnt in the ward. After seven hours the doors and windows were opened, and Drs. Prudden and Cheeseman immediately raised a dust from the floor and bedding and allowed it to settle in culture-media. All other sources of infection were excluded from the media. The culture produced so large a number of microbes that they overlay each other, but the observers were able to distinguish the *Streptococcus pyogenes* in the media, identical in form and appearance with the streptococcus which they had previously discovered in an umbilical phlegmon which one of the diphtheritic infants had in addition to the faucial diphtheria. Although more sulphur was employed than is recommended by the New York Health Board, it was inadequate to destroy the microbes.

Dr. Squibb, who is justly regarded as a high authority in matters pertaining to domiciliary disinfection, and to whom the above facts were communicated, replied that, in his opinion, the lack of success from the employment of the sulphur vapor as a disinfectant is due in part to the fact that it is used in too dry a state. If the sulphur be burnt over a wet sand-bath or in a room with boiling water, he believes that its germicidal power is greatly increased. Professor Prudden, witnessing the feeble germicidal action of burning sulphur, likens it to the burning of incense before the image of an offended deity, and says that it is scarcely more efficacious. Perhaps chlorine

is a more efficient germicide, evolved by adding sulphuric acid to a mixture of salt and black oxide of manganese, as employed by Professor Doremus in the Bellevue Hospital wards.

But attempts to prevent the spread of scarlet fever, as well as of diphtheria, by disinfection of the vacated room after the termination of the case, can only be partially successful if efficient preventive measures be not also employed during the continuance of the case, so as to prevent the formation of the poison or destroy it as soon as it is formed.

According to my observations, efficient prophylaxis requires the constant employment of disinfectants in the sick-room or upon the patient from the beginning of the disease or from the first visit of the physician.

Twenty-one years ago Dr. William Budd of Bristol, England, wrote of scarlet fever: "Time after time I have treated this fever in houses crowded from attic to basement with children and others, who have nevertheless escaped infection. The two elements in the method are separation on the one hand, and disinfection on the other."

I am not aware that Dr. Budd stated in detail his method of isolation and disinfection. The New York Health Board very properly gives directions that all objects not required to promote the comfort of the patient shall be removed from the sick-room; its floor and walls should be bare, and no one be allowed to enter it except the physician, nurse, and near relatives. For reasons already stated, books and other reading matter should not be allowed in the hands, upon the bed, or in the room occupied by a scarlatinous patient unless positive directions be given that they be subsequently burnt.

The attempt to prevent the spread of scarlet fever and the other infectious diseases by administering internally antiseptics and disinfectants to those who are exposed has, I believe, thus far met with little encouragement. It is a question whether the efficient antiseptics employed internally can, on account of their toxic properties, be safely used in doses sufficiently large to counteract the specific principle of scarlet fever when it has obtained lodgment in the system, so as to prevent the disease. Certainly, in the present state of our knowledge, the most efficient and reliable prophylactic measures consist in strict isolation of the patient, the disinfection of his person, disinfection of the air which surrounds him, and of objects and persons that are in close relation with him. It is quite possible, I think, by the employment of such measures, to realize the experience of Dr. Budd. I recommend for disinfection of the room at my first visit, to be used almost continuously during the progress of the case, the following prescription:

R. Acidi carbolici,
Olei eucalypti, āā. ʒj;
Spts. terebinth., ʒvj.—M.

Two table-spoonfuls are added to one quart of water in a tin wash-basin or similar vessel with broad surface, and maintained in a state of constant simmering over a gas or oil stove. The odor of this vapor is agreeable rather than unpleasant, and it appears to disinfect, to a considerable extent, the breath and exhalations from the body of the patient. At the same time, inunction is prescribed of the entire surface every three hours with the following:

℞. Acidi carbolici,
Olei eucalypti, āā. ʒj;
Olei olivæ, ʒvij.—M.

Pharyngitis, varying in severity according to the type of scarlet fever, is present in all cases. In not a few instances in New York City, where diphtheria prevails, either a diphtheritic exudate occurs upon the faucial surface, or the intensity of the scarlatinal inflammation produces a superficial necrosis, forming an eschar which is with difficulty distinguished from a diphtheritic patch. The breath exhaled over this surface is offensive, highly infectious if no disinfectant be used, and is no doubt the vehicle in numberless instances by which the disease is communicated. Therefore, the frequent application to the faucial surface of an antiseptic lotion or spray is strongly indicated, not only for its beneficial effect on the patient, as we will see hereafter, but as a means of diminishing the contagiousness of the disease. We will hereafter recommend as a disinfectant 1 part of peroxide of hydrogen to 3 parts of water, or 2 grains of corrosive sublimate to 1 pint of water, used as a gargle, or as a spray from a hard-rubber atomizer.

A sponge is too rough and irritating for the application of these or any other solution to the inflamed fauces. A large camel's-hair pencil, or surgeon's lint or absorbent cotton wound around a slender stick, may be used in the same manner in which Oatman and others employ it in the treatment of diphtheria, the application being made not only over the tonsils, but over the surface of the pharynx, behind and below the tonsils. Of course it is the anginose form of scarlet fever that more particularly requires this mode of treatment, and solutions of corrosive sublimate should be used cautiously, so that a toxic amount of it does not enter the system.

Antiseptic measures thus employed certainly greatly diminish the contagiousness of scarlet fever, but it is so very contagious that additional precautions should be taken. Constant ventilation of the sick-room should be maintained, whatever the weather, during the active period of the fever. This can be accomplished by a window partly open, a draft upon the patient being prevented by a screen, the temperature in the room being maintained at about 70° F., if necessary, by

a fire. No letter or written message or article of apparel or furniture should be sent from the room to any family during the continuance of the fever, nor afterward until proper disinfection be employed and sufficient time has elapsed. The cautious physician in attending scarlet fever will always bear in mind the possibility that his person or clothing may become infected, and be the vehicle by which the poison may be communicated to others. In examining the fauces of a patient he should stand a little to one side, so that no muco-pus, if the patient cough, be received upon his clothing, and he will not go directly from a scarlatinous patient to a child with another sickness or to a midwifery case without first washing his hands, hair, and face in an antiseptic solution and changing his outer apparel, or, if he be hastily summoned to a case without the opportunity of proper personal disinfection, he will approach no nearer the patient than is sufficient for a clear diagnosis.

Do health boards accomplish all that they are able to do in suppressing scarlet fever, as well as other contagious diseases? The exclusion from the schools of children living in houses in which the contagious diseases are occurring, the directions given for the disinfection of the bedding, clothes, and articles employed in the sick-room, and the promise to disinfect the sick-room when word is sent to the board, show a praiseworthy endeavor to eradicate diphtheria and scarlet fever as small-pox has been eradicated. But these measures are only partially successful. Many families in hired apartments never send word that they are ready for disinfection, and many in the cities move away as soon as the sickness is terminated in the belief that they can find more salubrious apartments elsewhere. The vacated rooms are rerented as soon as possible to families who have no knowledge of the previous sickness, and are surprised when their children immediately afterward are taken sick. Although the measures employed by health boards for domiciliary disinfection are often inadequate, it is the duty of attending physicians to see that they are carried out, such as they are, and to direct the employment of such other remedies as may seem necessary in order to prevent propagation of the disease.

The rubbing of the walls of the infected apartment with slices of fresh bread, which gathers up microbes, as recommended by distinguished authorities in bacteriology, and especially whitewashing or calcimining, or washing of the ceiling, walls, and floor with a solution of corrosive sublimate, should be insisted on before the apartment is again occupied.

Treatment.

Hygienic Measures.—The room occupied by a scarlatinous patient should be commodious and sufficiently ventilated. Its temperature

should be from 66° to 68° during the course of the fever. When the fever begins to abate and desquamation commences, the temperature of the sick-room should be a little higher, about 70° to 73°. In an equable and moderately warm temperature there is less danger of taking cold, and probably less danger of the occurrence of inflammatory complications, than in a cool and changeable temperature. It is true, as Henoch has said, that scarlet fever in itself is of such a nature that certain complications are liable to occur with the most judicious hygienic treatment. The best management does not always prevent the occurrence of otitis media or nephritis produced by the scarlatinous or secondary microbes. Still, it is the common belief—and my observations, extending through a third of a century, are in conformity with this belief—that careless exposure of patients to currents of air, or change from a warm to a cold air, as in mild cases when the presence of scarlet fever is not suspected, increases the liability to certain inflammatory complications, particularly to rheumatism and nephritis. The patient should therefore be in bed, lightly covered, during the active period of the disease; that is, from nine to twelve days. He should remain in his room so long as desquamation is going on—that is, from four to six weeks—and in inclement weather he should not go abroad until even a longer period has elapsed. When he leaves the house he should be warmly clothed.

Therapeutic Measures.—In order to treat scarlet fever successfully it is necessary to bear in mind that it is a self-limited disease, running a certain course and through certain stages, and that it is not abbreviated by any known treatment. Therapeutic measures can only moderate its symptoms and render it milder. The severity of the disease is indicated by its symptoms, and the symptoms are to a certain extent under our control.

Mild Cases.—A patient with a temperature under 103°, and with only a moderate angina, does not require active treatment; but, however light the disease, we have stated above that he should always be in bed and in a room of uniform temperature. Instances have come to my notice in which scarlet fever was not diagnosticated, and the patients were allowed to go about the house, and even in the open air, in the eruptive stage, till some severe complication or an aggravation of the type created alarm, and medical advice was sought, when it appeared that a grave and dangerous condition had, through carelessness and ignorance, resulted from a mild and favorable form of scarlatina. The physician, when summoned to a case, however mild, should never fail to take the temperature, note the pulse, inspect the fauces, and inquire in reference to the fæcal and urinary evacuations, that he may detect early any unfavorable changes which may occur.

Since in all cases angina and more or less blood-deterioration are

present, the following prescription will be found useful in mild as well as severe scarlet fever:

℞. Potassii chloratis, gr. xv to xx;
Tinct. ferri chloridi, f℥ij;
Glycerini, f℥ss;
Aquæ, f℥iiiss.—M.
Sig. Dose, one tea-spoonful every hour to two hours for a child of three years.

Glycerin and water appears to be a better vehicle in the above prescription than simple syrup, since it is more penetrating. Small doses of this medicine, frequently administered, act beneficially on the surface of the throat, and tend to prevent the anæmia which is so common after scarlet fever. If the medicine be given gradually, or if the patient gargle with it before swallowing, and no drink be given subsequently for a few minutes, a better effect is obtained upon the inflamed fauces. Potassium chlorate in large doses is known to be an irritant to the kidneys, causing intense hyperæmia of these organs, with bloody urine or suppression of urine. The melancholy fate of Fountaine, who died from the effects of one ounce of this drug, is known to the profession. I have seen a similar instance in a child. But doses of ½ to 1 grain can apparently be administered with safety to children, so that not more than 15 to 20 grains are given in twenty-four hours. A quantity much exceeding this involves risk. In mild cases quinine is, I think, useful as a tonic and an aid in maintaining a mild type of the disease. I have employed the following prescription:

℞. Quininæ sulphat., gr. xvj;
Syr. pruni Virginiani,
Syr. yerbæ santæ, āā. f℥j.—M.
Sig. Dose, one tea-spoonful every three or four hours to a child of three to five years.

The iron mixture, with or without the potassium chlorate, should be administered twice between the doses of quinine. In mild as well as in severe scarlet fever antiseptic measures are required to prevent auto-infection, as well as to prevent the propagation of the disease to others. The itching and dryness of the surface, which increase the discomfort of the patient in mild as well as in severe scarlatina, are relieved by rubbing the surface every two or three hours with a mixture consisting of 1 drachm of carbolic acid, 1 drachm of oil of eucalyptus, and 7 ounces of sweet oil, which should be well shaken before it is used. The following mixture, applied over the entire surface

every hour or every two or three hours, also relieves the burning and itching, while it has antiseptic properties:

℞. Acidi carbolici, ʒj :
Tinct. camphor., f℥ij ;
Aquæ puræ, Oj.—M.
Sig. Shake well before using, and apply over surface when needed for the pruritus.

Frequent antiseptic treatment of the fauces from the commencement of scarlet fever and during its progress, in mild as well as in severe cases, must be regarded as among the most important of the recent improvements in the treatment of this disease. Fränkel and Freudenberg[1] and Professor Hutinel of Paris—the last of whom has charge of the Pavilion for the treatment of the scarlatinal patients connected with L'Hôpital des Enfants malades—may be mentioned among those who recommend the early and frequent application of disinfectants to the fauces as a means of diminishing the severity of scarlet fever and preventing complications. The secretions from the faucial surface, and the faucial surface itself, contain numerous streptococci and certain other microbes. The streptococci greatly predominate, and are apparently active agents in producing the inflammation. Professor Hutinel says: "The micro-organism of scarlet fever is not yet isolated, but now we know the germs that are found in the lesions produced by the usual complications of the disease. In nearly all the cases of adenitis, arthritis, nephritis, endocarditis, and pleuritis from scarlatina the bacteriological examination has shown a streptococcus that is very much like, if it is not the same as, Rosenbach's pyogenic streptococcus." This is, adds Hutinel, constantly seen in the pharynx when the disease begins, and it certainly plays an important part in the genesis of the inflammations that are seen there.[2]

In the *Revue Mensual des Maladies de l'Enfance*, July, 1886, Fränkel and Freudenberg relate the results of their microscopic examination of cases of scarlet fever that died when the eruption was passing off. They found large numbers of streptococci in different organs; and these organisms presented the peculiarities of the streptococci of pus. The number of micro-organisms corresponded with the intensity of the inflammation, and they found large numbers of micrococci in the lymphatic glands in the immediate vicinity of the pharynx. These authors state that their observations teach them that in order to prevent secondary infection the physician must vigorously treat the local changes in the pharynx and adjacent parts from the beginning of scarlet fever.

[1] *Rev. Mens. des Mal. de l'Enf.*, July, 1886.
[2] *Archives of Pediatrics*, Sept., 1890.

Recent bacteriological investigations in reference to scarlet fever, therefore, have shown that microbes occur abundantly upon the inflamed faucial surface in this disease, and that of these microbes the streptococcus which is apparently identical with that which occurs in suppurative processes is the most abundant. Moreover, in the adenitis, cellulitis, and other internal inflammations which occur as complications or sequelæ of scarlet fever, the streptococcus abounds, according to the statement of the microscopists from whom we have quoted and others. All physicians know that scarlet fever, more than any other disease, is liable to be complicated and followed by inflammations which greatly increase its gravity and mortality; and the theory that the microbes which cause these inflammations originate to a great extent upon the inflamed faucial and nasal surfaces receives support from recent investigations. Even if the advocates of this theory have exaggerated the facts, we cannot, I think, fail to see in the present status of our knowledge that early and frequent disinfection of the fauces and nares in scarlet fever is of the highest importance as a means of diminishing the nasal and faucial inflammation, and diminishing or preventing inflammation of the Eustachian tube and middle ear, as well as of the lymphatic glands and the connective tissue of the neck. The best mode of treatment appears to be spraying or irrigation every half hour or hour with the peroxide of hydrogen, 1 part to 4 of water for the fauces, 1 part to 8 of water for the nares, or with some other non-irritating but efficient disinfectant. This local, non-irritating, antiseptic treatment should be perseveringly employed from the first visit in mild as well as in severe cases. We will return to this subject when treating of the complications.

Severe Cases.—The successful treatment of severe forms of scarlet fever requires not only skill and experience, but visits sufficiently prolonged or frequent to observe fully the symptoms and type of the disease and the effect of remedies. In the treatment of no other malady are sound judgment and correct discrimination more urgently needed than in scarlet fever of a severe type. The indications of treatment, so far as the patient is concerned, are—1st. To diminish to a safe degree the anatomical characters and symptoms; 2d. To sustain the strength or vital powers while the disease is running its course; 3d. To prevent complications and sequelæ.

Fever diminishes the secretions by which food is digested and destroys the appetite, so that repair of the waste is insufficient. Hence the progressive emaciation and loss of weight which attend the febrile state. Moreover, a high temperature, continuing for a time, tends to produce degenerative changes, albuminous and fatty, in the tissues—the higher the temperature, the more rapid the change—so that the functions of organs are seriously impaired. Billroth

says: "The production of heat depends chiefly on oxidation of the constituents of the body." Therefore fever indicates an increase of the oxidation and a molecular disintegration above the healthy standard.

Among the most dangerous of the tissue-changes produced by fever is granulo-fatty degeneration of the muscular fibres of the heart. In dogs and rabbits that have perished from a high temperature artificially produced by experimenters, granular clouding of the elementary tissues has been found after death.[1] A high temperature, therefore, in itself involves danger, and if it occur in an ataxic disease like scarlet fever, and be protracted, it greatly diminishes the chances of a favorable termination. Therefore measures designed to reduce the temperature when it has attained a high range are urgently needed.

The Use of Water.—The temperature can be reduced without shock or injury to the patient by the judicious use of cold water externally. It is to be remembered that a temperature at or below 103° does not urgently require reduction, since it is a grade of animal heat that is safely borne a few days. Nevertheless, patients with a temperature of 102° or 103° experience relief from sponging the fingers, hands, arms, forehead, neck, and face with cold water, to which vinegar or alcohol is added. The higher the temperature above 103°, the more urgently is its reduction required, but methods should be employed that do not shock or excite the child or weaken the pulse.

Before applying the water treatment for the reduction of temperature, the state of the patient as regards his strength and ability to react should be carefully ascertained. In grave or so-called malignant scarlet fever two forms of hyperpyrexia occur—namely, the sthenic and asthenic. The treatment by water, or by antipyretic medicines which may be proper for the sthenic cases, may be injurious for the asthenic, producing even fatal collapse. In sthenic cases, although the temperature may rise to 105° or higher, and the patient is restless or somnolent and restless alternately, and delirious, the pulse, though rapid, is strong and full; the rash has a bright-red color, and when removed by pressure with the finger, it immediately returns when the pressure is withdrawn. In such cases there is little danger of producing heart failure by the cold-water treatment. In asthenic cases delirium and restlessness or somnolence are also present, but the rapid pulse is easily compressed, the temperature is elevated to a dangerous degree, the skin has a dusky-red color, and the capillary circulation is sluggish. In such cases the injudicious use of cold water may cause such depression that the patient rallies with difficulty, or he may pass into a state of collapse and die. Although the internal temperature is dangerously high, that of the extremities may not be notably increased, and they

[1] "Experiments of Mr. Legg," *Lond. Path. Soc. Trans.*, vol. xxiv., and others.

are sometimes cool and livid. The cold-water treatment of such patients is pernicious, but hot applications to the extremities, with brisk friction, are grateful to the patient and useful in improving the circulation.

Dr. Currie of Liverpool first employed water as a therapeutic agent in scarlet fever in the commencement of the present century. When summoned at the beginning of a case he ordered the patient to be stripped, placed in a bath-tub, and five or six pailfuls of water at a temperature of from 68° to 77° Fahr. were thrown over his body during a quarter of a minute to one minute. The patient was immediately returned to bed and wrapped in blankets without being dried. Reaction generally occurred within fifteen or twenty minutes, and the affusion was usually repeated once or twice in twenty-four hours. When the parents objected to this treatment, and also when the attack had continued a few days, he employed tepid instead of cool water.

Currie stated that he treated in this manner 150 patients between the years 1801 and 1804, always with a good result. But more recent observations have shown that a uniformly good result is far from being obtained by any mode of employing water. Nevertheless, through the alleged benefit obtained by Dr. Currie, the cold-water treatment of scarlet fever came into use, and it has been continuously employed until the present time, often with benefit, but sometimes with harm, and even death. Trousseau, commenting on the treatment introduced by Currie, states that a large proportion of the severe cases with very hot skin and marked nervous symptoms, although benefited by the cold affusions, nevertheless perish; and public opinion is so averse to treatment by cold water that the physician who recommends it is likely to be strongly censured. In order to avoid censure, Trousseau says: "Very well, then, in place of giving your patients cold affusions, give them mere lotions of water at 25° (77° Fahr.). . . . . Let the patient be placed on a folding bed, and then let the entire body, first the anterior and then the posterior surface, be rapidly wetted with sponges soaked in this water, ... following the same rule as after the cold affusion." Trousseau speaks of the benefit derived from such treatment in diminishing the "extreme aridity and stinging heat," the skin becoming cooler and moist, and the cerebral symptoms diminishing, as also the diarrhœa and vomiting.

Von Ziemssen recommends the immersion of the patient in water at a temperature of 90°, and the gradual addition of cool water until the temperature of the bath falls to 77°. In a few minutes the patient is returned to bed and covered with bed-clothes, when the temperature will be found reduced two or two and a half degrees. If the patient complain of chilliness or his pulse be feeble, he should be immediately removed from the bath and whiskey or brandy administered; for if

the extremities remain cool and the capillary circulation sluggish, collapse may occur or some internal inflammation may arise. Ziemssen, like other physicians of experience, has discarded the use of cold water in adynamic cases when the pulse is weak, the surface dusky, and the capillary circulation sluggish, but uses instead hot or warm water and alcohol to the extremities.

Professor Henoch, in his treatise on *Diseases of Children*, American edition, says: "If the fever continue high, and the apparently malignant symptoms described above develop, the head should be covered by an ice-bag, ... and the child placed in a lukewarm bath, not under 25° R. (88.25° F.). I decidedly oppose cooler baths, because in scarlatina, which presents a tendency to heart failure, cold may produce an unexpected rapid collapse, more than in any other affection." In his more recent treatise, published by the New Sydenham Society, he also states that he does not approve of baths at a lower temperature than 88° Fahr. He says that on several occasions he has known collapse to occur while patients were in the bath, and in one instance death resulted.

Dr. K. Reimer of the Nikoläsvsky Hospital, St. Petersburg, read an elaborate paper on scarlet fever at the Third General Meeting of the Russian Medical Men, giving his observations during the twenty years ending with 1888. The paper was published in the *Transactions* of that society. He states that he has examined the effects of water in 978 grave or hyperpyretic cases of scarlet fever. Cold compresses to the head, neck, chest, and abdomen, and cold ablutions to other parts, have a soothing effect on the nervous system, but do not shorten the duration of the fever. The cold pack employed in 28 cases of great nervous excitement was followed not infrequently by cyanosis and heart failure. A cold pack prolonged an hour or more sometimes ended in fatal collapse. The cold pack, with cold irrigation, employed in 131 cases, was satisfactory as regards the pulse, circulation, and respiration, but it exerted little influence on the subsequent course of the fever. A tepid bath, employed in 72 cases, was useless, and was decidedly injurious if continued more than half an hour, causing a weak pulse. A bath of 95° F., gradually cooled to 81° F., or 75° F., employed in 186 cases, caused collapse and sudden death more frequently than any other hydrotherapeutic measure. A cold bath of from 64° F. to 75° F., continued from five to eight minutes, accompanied by energetic friction over the whole body, employed in 363 cases, gave the best results of all the modes of applying water. It caused a decrease of 3.6° F. in the temperature, as well as improvement in the pulse and respiration. Dr. Reimer adds that the cold bath in the hyperpyretic cases has a good and powerful effect on the nervous system, particularly upon the nervous centres that control the circulation; but he adds that the proper

mode of applying the water treatment must be determined by examining the peculiarities of each case.

Guided by the experience of such men as Trousseau and Henoch, are we able to formulate a method of employing water as an antipyretic in scarlet fever which we can confidently recommend to the profession? In all hyperpyretic cases of scarlatina, whether the form be sthenic or asthenic, accompanied by either restlessness or somnolence and delirium, an ice-bag or its equivalent, a linen or silk handkerchief wrung out of ice-water every five to ten minutes, should be constantly applied over the head as long as the temperature remains at or above 103°. The ice-bag should be about one-third full, so that it fits over the head like a cap. If a handkerchief be used, the popular objection to the use of cold may be in a measure overcome by adding one-fifth part of alcohol to the water, or, as Henoch recommends, adding vinegar to it. At the same time, as a potent means of abstracting heat, at least when the temperature is at or over 104°, a similar application should be made around the neck, and especially along its sides. Cold applied over the great vessels of the neck, the jugulars and carotids, promptly abstracts heat from the blood, while it diminishes the pharyngitis, adenitis, and cellulitis; which is an important gain. In sthenic cases, in which the extremities have a pungent heat, a bright-red color, and active circulation, the limbs should be frequently sponged with the cool lotion containing alcohol or vinegar. If the temperature with this treatment be not sufficiently reduced, the hands and forearms may be immersed in the lotion while the patient is still in bed, or a double thickness of muslin or linen, frequently wrung out of ice-water, may be placed over the hands and arms. This treatment is grateful to the patient, is not attended by any shock, and, continued two or three hours, it usually reduces the temperature two or more degrees.

In asthenic cases, with a dusky color of the skin, a sluggish capillary circulation, coolness of the extremities, or a pungent heat, cold applications, although beneficial when applied to the head and neck, are likely to be injurious if applied to the extremities. On the other hand, the frequent application to the extremities in these asthenic cases of tepid or hot water, with brisk friction, as recommended by Ziemssen and others, accelerates the flow of blood, revives the functional activity in the torpid limbs, and is evidently useful. Allowing the hyperpyretic patient to hold in the mouth and swallow pieces of ice has been a common practice for a long time and is very agreeable. I would also recommend for such a patient, especially when emesis is present and the quantity of nutriment retained is insufficient, a clyster every third hour of ice-cold peptonized milk containing one of the sarco-peptones. With proper precautions and discrimination of cases the use of water

in the way which has been described, where no renal complication exists, is, I think, entirely safe. I do not recollect that I have ever observed collapse, which has prejudiced so many good observers against its use, resulting from it when applied in the manner and with the precautions which I have mentioned.

Antipyretics.—The medicinal agents which have been most extensively used for the reduction of temperature in scarlet fever until within a recent period are quinine and aconite. One of these is regarded as a tonic, and the other is not actively depressing if given in proper doses, especially if combined with a small amount of alcoholic stimulant or digitalis. Veratrum viride, the American hellebore, was for a short time employed in this country, at least in New York, in hyperpyretic scarlet fever, but those who prescribed it subsequently discarded its use, since it is dangerously depressing and is liable to cause collapse. During the last three or four years three other powerful antipyretics have been extensively employed—antipyrine, antifebrin, and phenacetin. The time has arrived when the exact therapeutic uses of these agents should be ascertained. Von Ziemssen,[1] while he recommends hydrotherapeutic treatment of scarlet fever, expresses the opinion that antipyretic drugs are of secondary importance. In his recent treatise on the *Diseases of Children*, published by the New Sydenham Society, Henoch states that if the fever be persistently high, accompanied by drowsiness, restlessness, or delirium, he applies an ice-bag, gives quinine, 7 to 15½ grains, or antipyrine, 3½ to 7½ grains, or antefebrin, 1½ to 4½ grains. But he adds that antipyretic treatment does not succeed in the really malignant cases. In the treatment of such patients, he says, "I have never seen any successful result from the use of large doses of quinine, internally or subcutaneously, and I regard salicylate of sodium, as well as antipyrine and antifebrin, as remedies which are dangerous in such cases, and may favor the occurrence of collapse." Reimer, whose paper relating to scarlet fever, based on the analysis of 3640 cases, has already been alluded to, says that quinine employed in 148 cases, either by the mouth, rectum, or subcutaneously, had no notable effect on the temperature during the period of efflorescence, but was somewhat more efficient in the period of defervescence. The salicylate of sodium, employed by him in 431 cases, was injurious in its action on the heart, sometimes causing a cyanotic hue and heart failure. Kairin, employed in 36 cases, exerted a still more injurious action upon the heart, and it retarded respiration, while it had little influence on the fever. Thallin, employed in 48 cases, was unreliable and inconstant as regards its action on the temperature, in some cases not diminishing it, but in other cases rendering it subnormal, with symptoms of collapse. Reimer states that antipyrine was

[1] *Jaunnberg klinische Vorträge*, No. xiv.

employed in 684 cases, without abridging the course of the fever, but it seemed to enable patients to cope better with severe complications. He obtained more satisfactory results from antipyrine than from any other antipyretic medicine. The effects of antifebrin, prescribed in 522 cases, were not so good. It was more likely than antipyrine to cause cyanosis and a weak pulse.

Notwithstanding these adverse opinions, there is, I think, sufficient evidence that two antipyretic drugs are useful in certain cases, so that they may be confidently recommended to the profession. These medicines are aconite and phenacetin. Neither of them should probably be given in cases of extreme malignancy, characterized by feeble pulse, dusky color of the skin, sluggish capillary circulation, and delirium, with great restlessness or coma; but in hyperpyretic cases not markedly adynamic or malignant these remedies are apparently sometimes useful. In his interesting paper on the treatment of scarlet fever, read before the American Pediatric Society in 1889, Dr. Fruitnight stated that he had records of 63 cases of scarlet fever treated with aconite, with only 3 deaths. He had employed antipyrine and antifebrin in a considerable number of cases, but discarded them on account of the symptoms of cardiac depression and collapse which they sometimes caused. Dr. Fruitnight gives a table of cases showing the reduction of temperature produced by aconite. A child under the age of three years requires half a drop, and above the age of three years one drop, of the tincture of the aconite-root from every hour to three hours in the commencement of the attack. As the fever abates the interval between the doses should be longer. As stated elsewhere, it is not necessary to use the aconite or other antipyretic if the temperature does not exceed 104°. If there be asthenic symptoms, it should be administered with an alcoholic stimulant. I have also observed good results from phenacetin, administered in ½-grain doses to a child of eighteen months, and in 1-grain doses to children at the age of three to five years, every two or three hours, with an alcoholic stimulant. I repeat that in cases attended by marked depression it should not be prescribed, or it should be prescribed in small doses, its effects being carefully watched and an alcoholic stimulant be employed at the same time.

The Bromides.—If the patient be restless and delirious, and especially if he have jactitation, which is often a forerunner of convulsions, the bromide of sodium or potassium should be prescribed in doses of 5 grains every two hours for a child of three to five years. If the temperature be at or above 105°, and not reduced by the cold-water treatment, aconite or phenacetin may in some cases be advantageously employed at the same time. If convulsions occur, which in the commencement of scarlet fever result from the high temperature and the profound blood-poisoning, and at a later stage are uræmic, one of the

bromides in large doses, repeated every five or ten minutes, is an important remedy, while measures designed to remove the cause of the convulsions should also be promptly employed.

Digitalis.—Dr. Busey, in his article on scarlet fever in the *Cyclopædia of Diseases of Children*, says: "Digitalis is oftentimes not only necessary, but imperatively demanded, and may be given in very decided doses." Mr. Line, in his clinical notes based on 1000 cases, published in the *Birmingham Medical Review*, April, 1887, mentions digitalis among the useful remedies. Trousseau, Von Ziemssen, Cadet de Gassicourt, and West do not, so far as I am able to discover, mention digitalis among the remedies for uncomplicated scarlet fever, while a considerable number of physicians—among whom may be mentioned Rilliet and Barthez and Eustace Smith—recommend its use for scarlatinal nephritis. Stillé and Maisch say of the use of digitalis in typhoid fever: "Even its advocates have not shown that it abridges the disease or lessens its mortality, while it is abundantly demonstrated to impair the digestion, reduce the strength, and even to occasion sudden death. The use of digitalis in other forms of fever is equally unsatisfactory, and justifies the judgment of Traube, that the true field of action for digitalis is not fever." The condemnation of the use of digitalis by such high authorities in therapeutics should certainly be thoughtfully considered. I am not aware that I have observed any decided benefit from the use of digitalis in scarlet fever when uncomplicated by nephritis or uræmic symptoms, and, as we have other important remedies for every indication, it should probably seldom be prescribed for scarlatinal patients except as a remedy for nephritis.

Carbonate of Ammonium, Aromatic Spirit of Ammonia, Musk, and Camphor.—In severe cases with frequent and rapid pulse, in which antemortem heart-clots are liable to occur, ammonium carbonate is often useful. It should be dissolved in water and given in milk in as large doses as 3 grains every hour or second hour to a child of five years. It aids in producing stronger contraction of the cardiac muscular fibres, and thus diminishes the danger of the formation of thrombi. Ten-drop doses of the aromatic spirit of ammonia, given also in milk or in sweetened water, the vehicle being in sufficient quantity to prevent gastritis from the highly irritating nature of ammonia, may be prescribed as a substitute for the carbonate. The carbonate of ammonium has long been employed as a cardiac stimulant in scarlatina. In 1843, Rieckon of Brussels stated that in certain epidemics he had employed it with great success.[1] Rilliet and Barthez also prescribed it previously to 1861, but they state that it was most frequently unsuccessful in asthenic cases. Wendt also previously to 1861 recommended it in combination with musk. Nevertheless, other good observers speak doubtfully or dis-

[1] *Journ. des Conn. Méd.-chir.*, 1843.

paragingly of ammonium. Henoch says that he attaches little importance to carbonate of ammonium or to valerian, because they are too weak. Vidal[1] states that carbonate of ammonium was recommended twenty-five years ago as a remedy in scarlatina and other infectious diseases, but that experience has not confirmed its value. He, however, highly recommends the acetate of ammonium, formed by the combination of the carbonate of ammonium with acetic acid, given in doses of 15 grains for each year of the patient's age. A solution of this drug, known as spirit of Mindererus, has been considerably employed in America. Vidal states that it rapidly lowers the temperature, and is most effectual when employed near the commencement of the attack. Each table-spoonful of the spiritus Mindereri contains 10 grains of the carbonate of ammonium, neutralized by acetic acid. Judging from my own experience, and from what I can learn of the results obtained from carbonate of ammonium by others, I believe that it is a useful remedy as a cardiac stimulant, but inferior to the alcoholic preparations. I continue to use it in certain cases, prescribing it, as stated above, dissolved in water and given in milk.

Musk in doses of $\frac{3}{4}$ of a grain to 3 grains every two hours was at one time considerably employed, but it appears to be inferior in its action to camphor. Camphor should be prescribed in 1- or 2-grain doses every two hours. It may be employed hypodermically, as recommended by Henoch, dissolved in five times its quantity of rectified spirit and the same quantity of water.

Alcohol.—Alcohol, whether administered in one of the stronger wines, as sherry, or in whiskey or brandy, is a most useful remedy in scarlet fever, and is indeed indispensable in all grave cases which are attended by feeble capillary circulation and evidences of prostration. Milk is the best vehicle for this agent. Wine-whey or milk-punch should be given every hour or second hour. In scarlet fever, as well as in diphtheria, comparatively large doses are required, as a teaspoonful of whiskey or brandy every hour or second hour for a child of five years.

In our remarks on the treatment of mild scarlet fever we spoke of the importance of making frequent non-irritating antiseptic applications to the inflamed fauces and nares. In cases of severe or malignant type, attended by infiltration and swelling, and perhaps necrosis of the faucial surface, it is still more important that an antiseptic spray should be frequently employed, so as to destroy all microbes that are accessible.

During convalescence the hygienic treatment already described is important. Nutritious diet and a moderate amount of alcoholic stimulants are required, while the patient is kept indoors and protected from currents of air as long as desquamation is occurring, which may be

[1] *Bulletin de Thérap.*, Oct. 25, 1890.

six or eight weeks. More or less anæmia is present in convalescing patients, so that a mild tonic containing iron will aid in restoring the health. Elixir of calisaya-bark and iron, preparations of beef, iron, and wine, or the liquor ferri peptonati in tea-spoonful doses, will be found useful under such circumstances.

Complications and Sequelæ.

In the preceding pages we have recommended local measures designed to diminish or cure the pharyngeal and nasal catarrh, believing that the complications and sequelæ affecting internal organs, from which many patients die, have in a considerable degree a microbic origin; and it is probable, as we have already stated, that the microbes which produce this result are to a large extent propagated from the faucial and nasal surfaces. We have related in a preceding page the observations of Fränkel, Freudenberg, and Hutinel, showing the presence of microbes at the seat of internal inflammations which occur as complications of scarlet fever, and the probable microbic origin of at least some of these inflammations. This subject is so important that we feel justified in relating the following additional observations bearing upon this matter: In 7 cases of suppurative adenitis Raskin found the streptococcus constantly present. Lenhartz,[1] in an interesting paper on secondary affections in scarlet fever, says that he obtained from sections of affected organs a micrococcus from which cultures were made. It greatly resembled the erysipelas coccus of Fehleisen. Moreover, inoculations of mice made with pure cultures of it produced fatal erysipelas. The bacteriological investigations of Babes in scarlatina, which are corroborative of those already detailed, might also be related.

Guinon says: "Secondary infection in this disease usually occurs by way of the pharynx, and the penetration of microbes is favored by the loss of epithelium, by the dilatation of the lymph-channels, and the recumbency." Hence local antiseptic treatment of the nares and fauces is proper in all cases as soon as the inflammation appears, but it is especially required in the anginose form of scarlet fever, in which the inflamed surface is greatly thickened, is covered with foul secretions, and perhaps contains patches of pseudo-membrane or of necrosed tissue. Formerly, before the invention of hand-atomizers, it was necessary in making applications to the fauces to employ a brush, probang, or swab for those too young to use a gargle; but hand-atomizers, which are now in common use, afford a quick and easy method for making such applications. Four or five compressions of the bulb of an atomizer are sufficient to cover the fauces with the spray. Those atomizers with hard or bulbous tips are preferable, since those with slen-

[1] *Jahrb. f. Kinderheil.*, Bd. xxviii.

der metallic points are likely to prick the buccal or facial surface if the child resist and toss the head; but this accident may be prevented by directing India-rubber tubing to be drawn over the point in such a way as not to obstruct its action. For the local treatment of the fauces we employ and recommend, as stated in a preceding page, 1 part of peroxide of hydrogen and 3 or 4 of water every hour, or even half hour when the patient is awake.

The following mixture is also beneficial for local treatment of the fauces when they are foul and offensive from the exudations and secretions. It should be applied by a large camel's-hair pencil every three to six hours:

℞. Acidi carbolici,		gtt. x;
Liq. ferri subsulphatis,		f℥iij;
Glycerini,		
Aquæ puræ,	*āā.*	f℥j.—M.

Coryza.—In the first days of scarlet fever the coryza is slight, and no discharge from the nostrils occurs, so that mild preventive nasal injections three or four times daily suffice. But before the termination of the malady in cases of ordinary severity a nasal discharge usually supervenes, producing more or less redness and excoriation around the orifice of the nares. The coryza is most severe, and is attended with the greatest amount of nasal discharge in cases of the anginose type. Also in cases in which diphtheria supervenes this disease attacks the nasal surface, and requires prompt treatment by sprays or douches. It should be remembered that the Schneiderian membrane is midway in sensitiveness, as it is in location, between the conjunctival and buccal surfaces, and is readily inflamed by irritating applications. Applications made to it must be much milder than such as the fauces tolerate. They should always be applied warm, and a tea-spoonful of any mixture properly employed is sufficient for each nostril at one application. The applications should be made every two to four hours, according to the gravity of the case and the amount of the discharge. The best instrument for this purpose is a small syringe of glass with a curved neck and bulbous tip. The child's head should be thrown back, and the piston depressed rapidly so as thoroughly to wash out the nasal cavity. The application can also be made through an atomizer with a rounded tip or a tip covered by rubber tubing. The following is a useful prescription:

℞. Acidi borici,		℥j;
Sodii borat.,		℥ij;
Aquæ puræ,		Oj.—M.

Common salt, 1 drachm to 1 pint of warm water, has also been successfully used, and recently the peroxide of hydrogen, 1 part to 8 or 10 of warm water.

Otitis Media.—It is evident that the condition of the ear should be closely observed in and after scarlet fever. If the patient have earache, considerable relief may be obtained in the commencement by dropping a few minims of laudanum and sweet oil into the ear, and covering it by some hot application, either dry or moist, which will retain the heat. A light bag containing heated table salt or dry and hot chamomile-flowers will answer the purpose. Water as hot as can be well tolerated dropped into the ear or allowed to trickle from a fountain syringe, so as to fill the ear, is also very beneficial in allaying the pain. A 4 per cent. solution of nitrate of cocaine, with an equal quantity of laudanum, dropped into the ear will often give considerable relief. If the hot applications are not well borne, Dr. C. H. May recommends applying a long and narrow ice-bag immediately behind the auricle and extending under and in front of the ear, so as to cover the temporo-maxillary region, and at the same time instilling into the ear hot salt water (℥j to Oj) to which laudanum or cocaine is added.[1] Dr. May also states that antipyrine in large doses is useful in relieving the pain. If the pain be not quickly relieved, a leech should be applied at the base of the tragus. O. D. Pomeroy, an experienced aurist of New York, says: "Leeching, employed at the right time, rarely fails to subdue the pain and inflammation. The posterior face of the tragus is ordinarily the best place for applying the leech, but it may be applied in front of the ear or behind, wherever the tenderness on pressure is greatest. In my opinion, paracentesis may frequently be rendered unnecessary by the timely use of one or two leeches applied to the meatus."

If the otitis continue, as shown by pain in the ear, of which children old enough to speak bitterly complain, and which causes those too young to speak to press their fingers into or against their ears, this inflammation should not be neglected, as it may involve serious consequences. Multitudes of children have had permanent impairment, or even loss, of hearing, with caries or necrosis of the walls of the middle ear and of the mastoid cells, which might have been prevented by prompt and skilful management of the ear in the early stage of the inflammation. If, therefore, the otitis continue without mitigation of pain after the foregoing measures have been employed, paracentesis of the drumhead is probably required. The following directions for performing this operation, which will be useful to country practitioners who may not be able to obtain the assistance of a specialist, are furnished by Dr. Pomeroy: "The forehead mirror should be worn, in order to leave

[1] Pediatric Section of the N. Y. Acad. of Med., March 14, 1889.

the hand free to operate by either artificial light or daylight. A good-sized speculum is introduced into the meatus. Then an ordinary broad needle, about one line in diameter, with a shank of about two inches, such as oculists use for puncturing the cornea, should be held between the thumb and fingers, lightly pressed, so as not to dull delicate tactile sensibility. The part being well under light, the most bulging portion of the membrane should be lightly and quickly punctured with a very slight amount of force. The posterior and superior portion of the membrane is the most likely to bulge. The chordæ tympani nerve ordinarily lies too high up to be wounded. The ossicles are avoided by selecting a posterior portion of the membrane. After puncture the ear should be inflated by an ear-bag whose nozzle is inserted into a nostril, both nostrils being closed, so as to force the fluid from the tympanum. The puncture may need to be repeated at intervals of a day or two, provided that the pain and bulging return."

Albert H. Buck of New York, in an instructive paper read before the International Medical Congress in 1876, writes as follows of paracentesis of the membrana tympani in scarlatinous otitis: "In this one slight operation, which in itself is neither dangerous nor very painful, lies the power to prevent the whole train of disagreeable and dangerous symptoms." Buck relates the following example: A child of three years had complained of earache about twenty-four hours. "Toward morning," says he, "I was sent for, as the pain had become constant. . . . . An examination with the speculum and reflected light showed an œdematous and bulging membrana tympani (posterior half), the neighboring parts being very red, though as yet but little swollen. In the most prominent portion of the membrane I made an incision scarcely three millimetres (one-tenth inch) in length, and involving simply the different layers of the membrana tympani. This was almost immediately followed by a watery discharge (without the aid of inflation), which ran down the child's cheek. At the end of three or four minutes the child had ceased crying, and in less than a quarter of an hour she was fast asleep. At first the discharge was very abundant, and mainly watery in character, but it steadily diminished in quantity and became thicker, till finally, on the fourth day, it ceased altogether. On the tenth day the most careful examination of the ear could not detect any trace of either the inflammation or the artificial opening. The ear had probably been saved from ulceration of the drum membrane, long-continued suppurative otitis, and perhaps permanent impairment of hearing."

When an opening has been made in the membrana tympani, either by incision or ulceration, it is advisable in some instances to inflate the tympanum by Politzer's method, which has been alluded to above. The nozzle attached to an India-rubber bag is introduced into

the nostril on the affected side, and both nostrils are compressed against it. The patient fills his mouth with water, which he swallows at a given signal, as after the words *one, two, three*, spoken by the operator. During the act of swallowing, which opens the Eustachian tube, the rubber bag is forcibly compressed, which forces the air along the tube into the middle ear, and facilitates the escape of the pent-up secretions in the tympanic cavity. Dr. May recommends cleansing the nostrils and pharynx with a warm solution of common salt, one drachm to the pint, before the use of Politzer's bag.

If the otitis have continued unchecked by treatment until the secretions within it, after days and nights of suffering, have escaped by ulceration through the drumhead, the opportunity for prompt and certain cure is passed. Still, the patient under these circumstances may soon recover, or there may be the other alternative, in which the ear is badly damaged and chronic inflammation, established in the walls of the tympanum, gives rise to an offensive and protracted otorrhœa. In this state of the ear internal remedies should be prescribed, such as surgeons employ in suppurative inflammation of bones occurring in other parts of the system. Cod-liver oil and syrup of the iodide of iron are required, especially by patients of the strumous diathesis, the object being to promote a more healthy state of the system, so as to prevent extension of the inflammation and facilitate the healing process. Carbolized lotions, as the following, syringed warm into the ear in which there is otorrhœa, are useful in promoting cleanliness and increasing the comfort of the patient:

℞. Acidi carbolici, ʒss;
Glycerini, f℥ij;
Aquæ, f℥iv.—M.

But a safe, painless, and effectual agent for local treatment has been discovered in boric acid, by the use of which the discharge quickly diminishes, and the condition of the ear more certainly and rapidly improves than by the use of the carbolized lotions:

℞. Acidi borici, ʒiiss;
Glycerini,
Aquæ, āā. f℥j.—M.
Sig. Instil sufficient to fill the external ear three or four times daily.

Before the instillation is made the ear should be cleaned by syringing slowly with a wine-glassful of water, to which half a tea-spoonful of boric acid has been added, and the ear is then dried by pressure with a napkin. Some aurists employ finely-triturated powder of

boric acid dusted into the ear. The patient lies upon the side with the affected ear uppermost. By means of a scoop made of stiff paper or the segment of a quill as much of the powder is introduced into the ear as will cover a five-cent piece. By moving the ear it descends to the drumhead.

The following astringent has also been employed with good effect for the otorrhœa resulting from scarlet fever, as also in that from other causes:

℞. Zinci sulphatis,
Aluminis, āā. gr. v;
Aquæ puræ, f℥j.—M.

A few minims of this should be dropped into the ear, or if the ear be sensitive and painful 5 drops should be added to a tea-spoonful of warm water and dropped or syringed into the ear. But in protracted otorrhœa with granulations, which does not yield to the above treatment, aurists have successfully employed iodoform or its modified form, aristol. The ear should first be thoroughly cleansed by syringing with warm water and dried, and iodoform, to which a little balsam of Peru is added to mask the disagreeable odor, or aristol, should be pressed down to the bottom of the auditory canal by any convenient instrument. It is anodyne, astringent, and disinfectant, and should be employed in a dry state in considerable quantity.

The sequelæ of otitis media, such as granulations sprouting out from the drumhead, some of which may be of large size and are known as polypi, may require treatment by the aurist. A polypus may sometimes be removed by the forceps, or, better, by the snare. Polypi not large and favorably located can sometimes be cured by an astringent powder, as iodoform, sulphate of zinc, or alum, or by applying the liquid subsulphate of iron, considerably diluted. The otitis externa produced by the irritating discharge which flows from the middle ear soon disappears when the flow ceases.

Cellulitis, Adenitis.—Since the inflammation of the connective tissue and the lymphatic glands of the neck originates to a great extent from the foul secretions and the inflammation of the fauces, the disinfectant sprays for the fauces recommended above should be perseveringly used. Cool applications around the neck should be at first employed, and the following ointment should be frequently applied:

℞. Plumbi iodidi, ℥j:
Lanolin, ℥j.—M.

If the swelling produced by the adenitis and cellulitis be red from

the intensity of the inflammation, and very painful, suppuration is, according to my observations, inevitable, and a poultice of flax-seed or slippery elm will hasten suppuration and give most relief. But if the swelling be less acute, undergoing little change from day to day, the above ointment, constantly applied upon muslin or linen, will in many cases cause its gradual absorption and disappearance. In subacute cases attended by considerable tumefaction the constant employment of this ointment has, in my practice, produced better results than any other mode of treatment.

Nephritis.—This is a very important and common complication and sequel of scarlet fever. It usually commences in the declining period or during convalescence in mild as well as in severe cases. It is sometimes slight, producing but little aggravation of symptoms, but in other instances it changes the prognosis, causing death in cases which seemed to be favorable prior to its occurrence. The presence of albumin in the urine—which not in all instances, but as a rule, indicates the occurrence of nephritis—is more common in some epidemics than in others. Mr. Thomson[1] states that albumin occurred in 60 per cent. of 180 cases. Microscopical examinations also revealed in most of these cases the presence of casts and blood-cells. Heidenhain found albumin in 80 per cent. of the scarlatinous cases examined by him. On the other hand, Charles West discovered albumin in only 4 per cent. of the patients in one epidemic. It commenced most frequently at the end of the first or in the second week. Atkinson,[2] says in some epidemics albuminuria is present in 70 per cent. of the cases, and in other epidemics not more than 5 per cent, have albuminous urine. He makes the remarkable statement that Jaccoud has not seen a case of scarlatinal nephritis in fifteen years, and that he (Jaccoud) attributes the absence of this complication largely to the use of a milk diet. Certainly, in New York City, so far as my observations extend, in every epidemic of considerable extent a daily examination of the urine after the first few days reveals the presence of albuminuria in some cases, the proportion affected varying in different epidemics.

The *London Lancet*, Nov. 26, 1887, states that the statistics of 3000 cases of scarlet fever admitted into the London institutions showed a death-rate of 7 per cent. Albuminuria in an appreciable quantity and for a considerable time occurred in 15 to 20 per cent. of the cases; 83 scarlet-fever patients died in two of the hospitals, and some form of kidney disease was responsible for this result in 12 per cent. of the deaths.

Anatomical Characters.—Dr. William H. Welch, the pro-

[1] *British Med. Journ.*, Nov. 14, 1885.

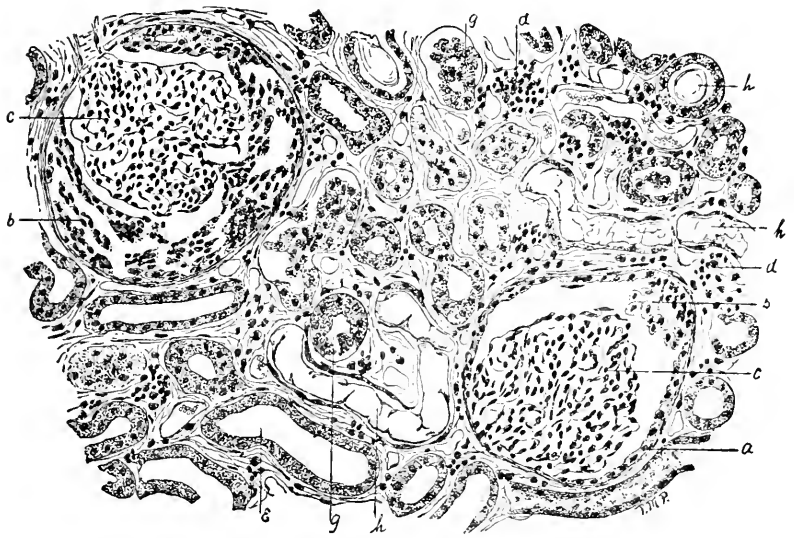
[2] *International Journ. of Med. Sci.*, July, 1886.

fessor of pathology in the Johns Hopkins University, in answer to a question of mine, wrote as follows in a note bearing the date of Sept. 16, 1891: "In regard to the renal complications of scarlatina, we have probably to distinguish the moderate transitory albuminuria accompanying the early stages and the height of the disease from the genuine scarlatinal or post-scarlatinal nephritis. The former is probably associated only with such parenchymatous changes as accompany many acute infectious fevers, and is not a genuine nephritis. The latter is in most cases a glomerulo-nephritis, with a varying amount of interstitial change in the form of small-celled infiltration. Whether the genuine scarlatinal glomerulo-nephritis is caused by the specific virus of scarlatina or by some complicating secondary organism is not settled."

Dr. Francis Delafield of New York, who has made many microscopical examinations of inflamed kidneys, says of *acute exudative nephritis* that it sometimes occurs as a complication of scarlatina, as well as of several other diseases, which he enumerates. He states that it has the characters of an exudative inflammation. The liquor sanguinis and the red and white blood-cells escape from the renal vessels into the tubules. "Swelling or necrosis of the renal epithelium and changes in the glomeruli" may also occur. In severe cases resulting fatally "we find the kidneys large and smooth, the cortex thick and white, or white mottled with red, or the entire kidney intensely congested. If the stroma is infiltrated with serum, the kidney is succulent and wet; if the number of pus-cells is very great, there will be little whitish foci in the cortex." The tubal epithelium is sometimes swollen and opaque. Hyaline cylinders identical with the casts are found in the convoluted tubes, and more abundantly in the straight tubes, along with irregular masses formed from the exuded blood-plasma. In the tubes are also red and white blood-cells. The glomeruli exhibit important changes. They become larger and more opaque, "due to the swelling and growth of the cells on and in the capillaries," for the glomerular capillaries in their normal state are covered on their outside by nucleated cells, and flat cells line their inner surfaces in places, not continuously. On account of these cellular changes the individual capillaries in the glomerulus become indistinct, but "the main divisions of the tufts are visible. . . . . In very severe cases the growth of the cells on the tufts is so considerable that they form large masses of cells between the glomerulus and its capsule. The walls of the arteries in the kidneys may be thickened by a swelling of their muscular coats." Acute exudative nephritis may be fatal, even rapidly, but in general those who recover, recover completely. The structural changes enumerated above are more marked in the cortex than in other parts of the kidney.

Acute Diffuse Nephritis.—Dr. Delafield says, in regard to this disease: "It is one of the forms of scarlatinal nephritis. . . . . The kidneys are large, at first smooth, later sometimes a little roughened; the cortical portion is thick, white, or mottled with yellow or red, or congested; the pyramids are red. In these kidneys we find the same lesions as have been described as belonging to exudative nephritis, but with two additional changes—changes which are found in the earliest stages of the inflammation, and which give the characteristic stamp to the lesion: first, a growth of connective tissue in the stroma; second, a growth of the capsule-cells of the glomeruli. These changes do not involve the whole of the kidney, but symmetrical strips or wedges in the cortex which follow the line of the arteries. These wedges are small or large, few or numerous, regular or irregular, in the different kidneys. But in every wedge we find the same general characters: one or more arteries, of which the walls are thickened; glomeruli belonging to these arteries, with a large growth of capsule-cells compressing the tufts; a growth of new connective tissue in the

FIG. 4.



Acute Diffuse Nephritis in Scarlatina (Delafield and Prudden).

a, Swollen capsular epithelium; *b*, proliferation of tuft-cells; *c*, compressed tuft; *d*, swollen stroma infiltrated with cells; *e*, dilated convoluted tubules; *g*, swollen epithelium peeling off; *h*, hyaline casts.

stroma, around and parallel to the arteries. Between the wedges we find at first only the changes of exudative nephritis; later, a diffuse growth of connective tissue. If the nephritis is of acute type and recent, the new tissue between the tubes consists largely of cells; if the nephritis is of subacute type and longer duration, the tissue is

denser and has more basement substance. Where the growth of the new tissue is abundant the tubes become small and atrophied. The exudation from the blood-vessels is very considerable, so that the urine contains large quantities of albumin, many casts, and red and white blood-cells."[1]

The nephritis complicating and following scarlet fever is frequently more dangerous than the primary disease. A clear appreciation of its therapeutic requirements is important, since by judicious treatment many recover who would inevitably be sacrificed by improper measures. The family should be informed that the danger from scarlet fever does not cease with the decline of the eruption, and that the kidneys may become seriously affected when the patient is in other respects fully convalescent. The presence of albumin in the urine, which is readily detected, is commonly believed to be sufficient evidence of the occurrence of nephritis. But we have seen, from the note from which I have quoted, that Professor Welch expresses the opinion that there is an albuminuria of short duration due to slight and transient parenchymatous changes in the kidneys, not nephritis, and the late Professor Austin Flint wrote as follows: "Transient slight albuminuria occurs in scarlet fever, as in various other affections, without denoting renal disease."[2] This transient and slight albuminuria without nephritis occurs during the height of scarlet fever, when the temperature is elevated and the patient is seriously sick in other respects than as regards the urinary apparatus. Owen Fowler, in his remarks on 2000 cases of scarlet fever occurring in four years in the London Fever Hospital, states that albuminuria was sometimes due to the high temperature.[3] The albuminuria which results from acute diffuse nephritis, and indicates its presence, occurs for the most part when the scarlatina is abating or has abated, and it continues as a sequel. Unlike the transient albuminuria alluded to by Professors Welch and Flint, it is attended by the presence of more or fewer blood-cells and casts in the urine.

The cause of scarlatinal nephritis is an interesting subject for investigation. Professor Flint says: "It is an important question whether this sequel proceeds exclusively or chiefly from an agency pertaining intrinsically to scarlatina, or whether it depends on extrinsic causes, such as the action of cold."[4] Mr. Thomson[5] quotes the opinion of Mr. Dickenson, that only a small proportion of the cases of scarlatinal nephritis are due to taking cold. Professor Welch, whom we have already quoted, says that the question is not settled whether the scarlatinal glomerulo-nephritis is "caused by the specific virus of scarlatina

[1] *Handbook of Path. Anat. and Histol.*, Delafield and Prudden, New York, 1889.
[2] *Practice of Medicine*, p. 1055.
[3] *Brit. Med. Journ.*, Nov. 14, 1885.
[4] *Ibid.*, p. 870.
[5] *Loc. cit.*

or by some complicating secondary organism," considering it admitted that it is caused by one or the other; in other words, that it is due to a microbe.

We are prepared, from the consideration of other internal inflammations occurring as complications or sequelæ of scarlet fever, to accept the theory that the cause of the nephritis pertains "intrinsically to scarlet fever" in certain cases, and that in these cases it is microbic. We have seen that bacteriologists have discovered microbes, the streptococci predominating, at the seat of inflammation in the otitis, arthritis, pleuritis, pneumonia, pericarditis, and endocarditis complicating scarlet fever. Moreover, we have stated elsewhere that in 13 of 14 cases of albuminuria and œdema occurring in scarlatinal nephritis, it is reported that Babes found the streptococcus either alone or associated with the pneumococcus of Talamon-Fränkel in the kidneys. Nevertheless, it is well known that nearly all writers on nephritis occurring independently of scarlet fever regard taking cold as the most important factor in producing it, and from the observation, extending through many years, of cases of scarlatinal nephritis, it has seemed to me that those who are in bed or in a warm room until the acute symptoms have abated, and are carefully housed or warmly clothed during the period of desquamation, are more likely to escape the nephritis than are those who are early and carelessly exposed to currents of air or outdoor weather. Moreover, as I have had opportunities to observe, the mildest cases of scarlet fever, in which the system is so slightly affected that the presumption is strong that the kidneys cannot be injured by the direct action of the poison or by microbic agency, nevertheless are liable to contract nephritis if early and injudiciously exposed to outdoor weather. Thus I recall to mind a case of severe scarlatinal nephritis which occurred in the favorable season of midsummer, and was nearly fatal from eclampsia. The parents at first said that the child had not had scarlet fever, but finally said that it had had a rash two weeks previously, which they supposed was due to the summer heat, and during the continuance of which it played every day in the open air. The frequency of nephritis after very mild attacks of scarlet fever has, I think, been correctly attributed to the fact that such cases are carelessly treated as regards exposure to the weather.

What are we to infer from these facts? It seems to me that in many cases, especially in those of a severe type, the glomerulo-nephritis is caused by the action of microbes, and that the proofs of this are sufficient, as we have elsewhere stated, to justify, as a means of preventing the renal inflammation, the frequent disinfection by non-irritating but efficient antiseptic sprays or irrigation of the nasal, post-nasal, and faucial surfaces from the earliest possible moment. I need not here repeat what I have stated elsewhere in regard to the kind of antiseptic which

will probably be most serviceable, for the same antiseptic treatment which we rely on for preventing the superficial inflammations, as the adenitis and cellulitis, will probably be successful in preventing the more serious and deeper-seated renal inflammation if the theory of the microbic origin of the latter be correct, even if the nephritis have commenced. I must state my belief that disinfection of the nasal, post-nasal, and pharyngeal surfaces should be employed daily as long as they exhibit the inflammatory appearance.

But since clinical observations justify the belief that exposure to cold causes the nephritis in certain cases, as it is known to cause nephritis occurring independently of scarlet fever, the patient should be kept in bed during the scarlet fever, however mild it may be, and in a comfortable and warm temperature during the three or four weeks of desquamation. The physician should never discharge a scarlatinous patient, although his health is apparently entirely restored, without one or more examinations of his urine at his last visits. When his visits cease the nurse should be instructed to make the examinations by heat and nitric acid twice weekly during the ensuing month, and if any evidence, however slight, appear that the kidneys are involved, the physician should be notified, in order that appropriate treatment may be immediately commenced. Early and correct treatment of the nephritis is attended by much better results than delayed treatment, and many more patients are doubtless now saved than in former times, when little attention was given to the state of the kidneys until dropsy or other prominent symptoms appeared. I have found no mother or nurse so ignorant that she could not properly employ the tests of nitric acid and heat; and if she be solicitous for the welfare of the child, she will not hesitate to carry out the directions, and notify the physician if the tests employed produce the least cloudiness or turbidity of the urine.

The patient, as soon as nephritis begins, should be put to bed in a room of warm and equable temperature (72° F. to 75° F.). His diet should be liquid, consisting of milk, farinaceous food, and a moderate quantity of animal broths. He may drink liquids freely, especially water not too cool, to which spiritus ætheris nitrosi is added. If there be marked prostration from the primary disease, alcoholic stimulants should be allowed.

The indications of treatment are to relieve the hyperæmic kidneys by diaphoresis and purgation, and when this is effected to increase the quantity of urine, which is usually diminished, and thus eliminate that poisonous product, urea, which is the chief noxious principle generated in the system in this disease. To produce diaphoresis the patient should be immersed in a warm bath at about the temperature of the body (98° to 100°), in which, if he be quiet and comfortable, he should

remain from fifteen to twenty minutes, but a shorter time if restless and frightened by the water; after which he should be placed in a warm bed and well covered by blankets. If perspiration result, the bath has been useful, and it may be employed in grave cases two or three times daily. If perspiration do not result, it may be produced by surrounding the body by hot air, either dry or moist. Hot air may be produced by burning alcohol in a thin layer upon a plate under a chair upon which the patient sits surrounded by a blanket, or he may be covered in bed and the hot air introduced under the bed-clothes. In New York City a convenient apparatus is used for this purpose, consisting of a small sheet-iron pipe enclosed in a small box of the same material. The box is in the form of a trunk, with a handle for convenience in carrying, and the lower end of the pipe, which extends nearly to the floor, contains an alcohol lamp. Hot moist air may be produced by placing bottles of hot water surrounded by towels wrung out of water against the body and limbs of the patient, who is suitably covered in bed. The steam arising from them and enveloping the body and limbs produces a prompt sudorific effect. There is in use in New York City a convenient apparatus for generating steam in the treatment of these and other cases requiring diaphoresis. It consists of a cylinder pierced with holes for the admission of air, and containing a spirit lamp, over which is a pan or pail holding a little water. The patient, nearly denuded, is placed in a chair with the apparatus underneath, and is covered by a blanket, so that the steam surrounds the body. This gives rise to free perspiration, which continues after the patient is placed in bed. By means similar to the foregoing a sufficient sudorific effect can usually be produced.

The sudorific effect of the treatment by external warmth described above should be aided by the use of diaphoretics. Those which have been most prescribed are the liquor ammonii acetatis, the acetate of potassium, the bitartrate of potassium, the citrate of potassium, and the spiritus ætheris nitrosi. If employed when the surface is cool, these medicines act rather as diuretics than diaphoretics. Being simple in their action and without deleterious effect, they may be given frequently and in large proportionate doses for the age. The following will be found a useful mixture having diaphoretic, diuretic, and laxative properties:

℞. Potassii acetatis,
Potassii bicarbonatis,
Potassii citratis, *āā.* ʒij;
Infus. tritici repentis, ℥viij.—M.

Dose. Give one tea-spoonful every three or four hours to a child of five years.

But during the last few years a diaphoretic has been discovered and employed which surpasses those previously prescribed in power and efficiency, and which in cases of unusual gravity, when other remedies have failed, is, I believe, sometimes instrumental in saving life. I refer to pilocarpine, the active principle of jaborandi. Being soluble in water and tasteless, it is easily administered, and is retained when, on account of the uræmic poisoning present, the stomach is irritable, and medicines that are unpleasant to the taste are liable to be vomited. The alcoholic stimulant may be increased at the time of its use, in order to guard against any depressing effect. To a child of two years from $\frac{1}{40}$ to $\frac{1}{20}$ of a grain may be given every six hours or every four hours, by the mouth. It may be employed hypodermically—$\frac{1}{20}$ of a grain to a child of five years. It has both a diuretic and a diaphoretic action, and it stimulates both the salivary and mucous secretions. According to one observer, an adult when fully under the influence of pilocarpine secretes from one to two pints of saliva in two hours, and Leyden reports a case of diphtheritic nephritis in which the quantity of urine rose from half a pint to five pints daily. But its most prompt and certain action is on the sweat-glands. Hirschfelder speaks of its beneficial action in relieving various forms of dropsy, and adds: "In one morbid condition of the kidney, however, jaborandi is the remedy *par excellence*, and that is the acute parenchymatous nephritis which frequently follows scarlet fever. . . . . This disease heals spontaneously if the danger which threatens life from the reduction of urine, and from the effusion of fluid into the cavities of the body, be averted. In this disease jaborandi works wonders." I have also found it an invaluable agent when the older remedies failed and death seemed imminent. The following cases, in which the beneficial action of this agent was apparent, occurred in my practice:

Case 1.—G——, male, aged five years and six months, sickened with scarlet fever June 2, 1882. The case progressed favorably, and during the convalescence my attendance ceased. On June 24th my attention was again called to the child, when the urine was found to be scanty and very albuminous. The common treatment was employed —to wit, warm baths, derivatives over the kidneys, laxative doses of jalap, and the potassium bitartrate. The urine, however, remained scanty—2 ounces in twenty-four hours—and on June 28th severe convulsions occurred, which were controlled by doses of bromide of potassium and 5-grain clysters of chloral. The muriate of pilocarpine was now given in doses of $\frac{1}{32}$ of a grain every three hours in cold water. This was not vomited, and it must have been given in larger doses than that directed, for on July 1 the bottle, containing one grain, was empty. The mother stated that the child had taken only two doses, or $\frac{1}{16}$ of a grain, of the pilocarpine, when both the diuretic

and diaphoretic effects were apparent. The mother also stated that the quantity of urine was larger when the pilocarpine was administered every third hour than when given at a longer interval. A flaxseed poultice dusted with mustard was also applied over the kidneys. Occasional convulsive attacks continued to occur, which were readily controlled by enemata of chloral. On June 30th all the symptoms were better: no more attacks of eclampsia had occurred, and the urine was more abundant and less albuminous. The mother remarked that the new medicine had settled the stomach and increased the urine. The record for July 4th states: "Continues to improve; takes the muriate of pilocarpine, $\frac{1}{32}$ grain, every six hours, and has not vomited since he began to take it; pulse 106, temperature 99°; is playful; passes urine freely, and takes nearly three quarts of milk daily, with some farinaceous food. July 6th, is fully convalescent; pulse 92, temperature 99°; perspires much; urination normal in quantity and character."

CASE 2.—Mary S——, aged five years, was exposed to her brother who had scarlet fever, and about the same time she had sore throat without any efflorescence. Nearly two weeks subsequently (Dec. 22, 1882) she had the symptoms of severe nephritis; her urine was reduced to 4 ounces in twenty-four hours, and was highly albuminous. A powder of calomel 3 grains and of resin podophyllin $\frac{1}{6}$ grain was prescribed, and it produced one stool. One-twentieth of a grain of muriate of pilocarpine administered was vomited, but another dose was taken at 10 P. M., and the mother says that the patient "sweat fearfully" during the night. Three or four doses were administered daily during the following week, and when not vomited they usually produced perspiration lasting from one to one and a half hours. The record for Dec. 30th is as follows: "Takes $\frac{1}{20}$ grain pilocarpine twice daily, and occasional doses of infusion of digitalis; urine more abundant, its specific gravity 1014, slightly albuminous, and containing very few granular casts and blood-corpuscles; has lost its smoky appearance; reaction alkaline; perspiration slight; patient convalescent."

Other similar cases might be related, sufficient, I think, to show that pilocarpine given, as in the above cases, in moderate doses and with sufficient interval, does not produce any deleterious effect, and is a very useful remedy in scarlatinous nephritis. It is a remedy, however, that should be given cautiously, at sufficiently long intervals, and discontinued when the urgent symptoms are relieved. I have seen in one instance fatal bronchorrhœa rapidly develop in a child that had taken this medicine in too large or too frequent doses.

In the treatment of scarlatinous nephritis laxatives or purgatives of a hydragogue nature are very beneficial, especially when dropsy occurs or symptoms indicating uræmic poisoning are present. Their

action is more certain than that of most diaphoretics and diuretics, and their employment is imperatively required in severe or dangerous cases, in which it is necessary to remove as soon as possible the serum or urea which endangers life. Young children, or those with delicate stomachs and those much enfeebled by the primary disease, may take magnesia, either the citrate or the calcined. A good cathartic for ordinary cases is a mixture of jalap and potassium bitartrate, the pulvis jalapæ compositus, consisting of one part of jalap and two of cream of tartar. Ten grains of the mixture may be given to a child of five years, and repeated in from two to four hours, according to circumstances. Its effect is increased by dissolving a tea-spoonful of potassium bitartrate in a gobletful or half a gobletful of water, and allowing the patient to drink from it. The following cathartic also acts promptly and beneficially in the treatment of scarlatinal nephritis:

℞. Olei cinnamomi, gtt. viij;
Magnesii sulphat. ℥j;
Potassii bitartrat., ℥ij.—M.
Sig. One tea-spoonful repeated at intervals of from two to four hours until catharsis occurs.

After the use of laxative agents, the kidneys, being less congested on account of the diversion that has occurred, often begin to excrete urine more freely. But if the patient be anæmic or enfeebled, and the symptoms due to the nephritis be not urgent, it is frequently better to avoid active catharsis, which reduces the strength more or less, and employ remedies of a sustaining character, as in the following case, which occurred in my practice: A little boy, pallid and scrofulous, began to have anasarca after scarlet fever, chiefly in the scrotum, with a moderate degree of ascites. The urine, which was passed in nearly the normal quantity, contained albumin, but not in large amount. The patient gradually and fully recovered with no treatment except the use of iron internally and the application of an oil-silk jacket over the kidneys and abdomen to produce diaphoresis. Such a patient, treated by the powerful eliminatives which we employ for the more urgent and robust cases, would probably have been injured rather than benefited. No treatment can therefore be recommended for scarlatinal nephritis which will be strictly applicable to all cases. Variations are demanded according to the state of the patient and the form and gravity of the disease.

Diuretics which do not stimulate the kidneys are proper at an early as well as late period of the renal malady, and digitalis is the one usually prescribed. I do not hesitate to order it from the first day in combination with acetate of potassium. One tea-spoonful of the

infusion may be given every third hour to a child of five years. The following formula is for one of this age in good general condition:

℞. Potassii acetatis, ℥ss;
Infus. digitalis, f℥vj.—M.

Local treatment should also be prescribed, since it furnishes important aid in subduing the nephritis. Thomas, Romberg, and others have recommended the application of leeches over the kidneys. Thomas says: "In many cases the abstraction of blood causes immediate and permanent relief; the fever and the pain in the region of the kidneys cease, the secretion of urine becomes augmented, the albuminuria lessens from day to day, and the moderate degree of dropsy that has been developed disappears." Abstraction of blood by leeches or otherwise I have never employed, and it is likely, in my opinion, to do harm rather than good, unless, perchance, it may be of service in exceptional instances in robust children who have not been perceptibly reduced by the primary disease. In the majority of cases, instead of depletion, a poultice, slightly irritating, between two pieces of muslin, should be constantly worn over the kidneys as long as the albuminuria or nephritic symptoms are pronounced. A poultice of equal parts of pulverized flaxseed and ginger, or of 1 part of pulverized mustard and 16 of flaxseed, mixed with sufficient water to moisten thoroughly the cloth which retains it, is the best for this purpose. Older children, not likely to be frightened by the process, may be treated by the daily application of dry cups over the kidneys while the body is warmly covered. In subacute cases, not attended by any alarming symptoms, sufficient redness may be produced over the kidneys by any one of the well-known mildly irritating plasters constantly worn.

Eclampsia is another not infrequent complication in scarlet fever. It is caused during the first stages or in the active period of scarlet fever by the irritating action of the scarlatinous poison upon the nerve-centres; but, occurring at an advanced stage of the disease or in the declining period, it is in most instances caused by the retained urea. The same remedies are required to control the convulsive movements as when they occur under other circumstances. The bromide of potassium or sodium should immediately be administered in large and frequent doses whenever eclamptic symptoms arise. During an attack of eclampsia a child of three years should take 5 grains of either of these agents every five to ten minutes until the convulsive movement ceases, and then at longer intervals. Chloral is a more powerful agent, and if the eclampsia be not quickly controlled, I commonly

employ it *per rectum*, dissolved in one or two tea-spoonfuls of water. For a child of three to five years, 5 grains should be thrown into the rectum by a small glass or gutta-percha syringe, and retained by pressure. Properly administered and retained, it rarely fails to control the eclampsia within ten or fifteen minutes. Subsequently, occasional doses of the bromide should be given to prevent the recurrence of eclampsia, while measures are being employed to diminish the severity of the scarlet fever and perhaps to eliminate the urea.

Inflammation of the joints, believed to be in most instances rheumatic, but in some instances, perhaps, having an origin different from rheumatism, endocarditis, and pericarditis, arising as complications or sequelæ, require the treatment which is appropriate when they occur under other circumstances; but the remedies should not be depressing, as the system is already enfeebled by the primary disease. The rheumatic nature of the affection of the joints is rendered probable by the fact that it is in some patients immediately followed or complicated by endocardial or pericardial inflammation, like idiopathic rheumatism. If the arthritic affection be mild, it commonly abates in a few days, even without medication, with some soothing lotion and support. The following liniment may be applied upon muslin and covered by cotton wadding:

℞. Acidi carbolici,	f℥j;
Tinct. belladonnæ,	f℥j;
Ol. camphorati,	f℥ij.—M.

If the arthritic inflammation be severe and occur in several joints, it may increase the fever and suffering of the patient. Under such circumstances doses of the sodium salicylate, as in idiopathic rheumatism, have a beneficial effect, reducing the fever, inflammation, and suffering. In severe cases an occasional opiate alleviates the pain and gives sleep.

Endocarditis and *pericarditis* require rest in the horizontal position, avoidance of all excitement, and, if the pulse be frequent and weak, a dose of digitalis or digitalis and strophanthus at regular intervals, as every third hour. I prefer the following combination:

R. Tinct. strophanthi,	f℥ss;
Tinct. digitalis,	f℥j.—M.

Dose, 4 drops every three or four hours to a child of five years.

The same external treatment is required as in acute pleurisy. I prescribe the application of a thin poultice of flaxseed containing $\frac{1}{16}$ part of mustard and covered with oiled silk. The cardiac inflammations

often require the use of a bromide in sufficient dose to procure quiet and sleep, aided perhaps by paregoric, which does not weaken the heart's action, but rather strengthens it on account of the alcohol and camphor which it contains. The physician should enjoin a quiet life and freedom from excitement for weeks after the signs of endocarditis or pericarditis have abated.

Pleuritis, which is one of the most dangerous and protracted sequelæ of scarlet fever, and which is very likely to be suppurative, demands the same treatment as when it occurs in cachectic patients.

MEASLES.

In order to employ the proper prophylactic and therapeutic measures for the prevention and cure of a disease, its cause and nature should be ascertained. It is the universal belief that measles is a microbic disease. Micrococci were found in the blood of rubeolar patients by Coze and Feltz. Keating also discovered them during an epidemic of malignant measles,[1] and Ransome, Braidwood, and Vacher found them in the breath of patients as well as in their tissues.[2] Whether the causal agent be a coccus or some other microbe, the incubative period, though probably varying in different cases, appears to be on the average about nine days from the time of exposure until the commencement of the first symptoms, or twelve to fourteen days from the time of exposure until the commencement of the eruption.

Prophylaxis.

Measles seems to be contagious as soon as the first symptoms appear; that is, three or four days before the eruptive stage. It is contagious during the eruptive stage, and how long afterward has not been clearly ascertained. It is communicated by the breath of the patient, and probably by exhalations from his surface. It has been inoculated by the serum from vesicles which sometimes occur in connection with the rubeolous eruption, and also by the blood of a patient. Inoculation does not seem to render the disease milder, and as measles, when contracted in the ordinary way, is not in itself dangerous, but dangerous only from complications, inoculation is not performed except as a matter of scientific interest. The communication of measles is believed to be in all cases directly from the patient. The specific germ, unlike that of scarlet fever and diphtheria, but like that of pertussis, does not adhere to objects handled by the patient or in his immediate vicinity; nor does it adhere to the clothes, bedding, furniture, or walls

[1] *Phila. Med. Times*, Aug. 12, 1882. [2] *Brit. Med. Journ.*, Jan. 21, 1882

of the apartment occupied by the patient. Some instances have been related in which it was stated that it was communicated by a third person; but it seems probable, from the nature of the disease, that these observations were fallacious, and perhaps a mistake was made in the diagnosis. The specific principle is, therefore, so volatile, so slightly adherent to objects, that domiciliary disinfection is not required after the termination of a case. Open doors and windows, complete renewal of the air of the apartment occupied by the patient, airing of his clothes and bedding, and the washing in boiling water of such articles as are worn next his body or have been in contact with his surface, are sufficient precautionary measures to prevent the spread of the disease as regards the management of the sick-room and the articles which it contains.

But, while these statements are correct, nevertheless measles is so highly contagious that it is much more difficult to prevent its propagation when it is introduced into a family, school, or asylum than in the case of diphtheria or scarlet fever. The specific principle of measles is so volatile, and its area of contagiousness extends so far, that the most rigid quarantining of the patient at a distance from healthy children is necessary to prevent its propagation.

Treatment.

Uncomplicated measles requires little medicinal treatment except to palliate symptoms. The child should be kept in an airy apartment, at a uniform temperature of about 70°. The room should be darkened by lowered curtains and the exclusion of bright lights, since a bright light is painful to the patient on account of the conjunctivitis which accompanies the disease. Moist air in the room is also preferable to dry air. While the popular idea is erroneous that the patient should be kept in a heated atmosphere, it is correct that currents of air and sudden reductions of temperature are dangerous. A violent and fatal attack of croup occurred in my practice in a girl of fifteen years, apparently in consequence of exposure at an open window at the close of the eruptive stage. The patient should be kept in bed, constantly covered, from the time that the diagnosis is made until not only the eruption, but the fever, has disappeared. He should remain in the room, comfortably warm (70°) and free from draughts of air, until the cough ceases.

These precautionary measures, designed to prevent complications, are important. Several years ago the only child of a well-known New York family, a girl aged five years, when thickly covered with the rubeolar eruption, was allowed to sit with its parents at the dinner-table, and when helping herself to a drink the rash suddenly disappeared, and severe eclampsia occurred, ending in a few hours in coma and death. The case was promptly treated by Dr. John L. Campbell

and myself, but without apparently retarding the fatal progress of the attack. There can be little doubt that the case would have progressed favorably, and the child would now be alive, if she had remained warm and quiet in bed during the progress of the measles.

Intelligent parents, with the best intentions and devoted to the welfare of their children, frequently err in regarding measles as a trivial disease. Epidemics of it do not occur in any of the institutions with which I have an official connection without causing a greater or less mortality, and mainly from inflammatory complications. During the two or three weeks succeeding an attack care should be taken to avoid exposure to cold or to sudden changes of temperature, since there is great liability to inflammation of the mucous surfaces until the health is fully restored.

The diet in measles should be mild, and for the most part liquid. The patient, indeed, refuses solid food, but on account of the thirst takes liquids more readily. Farinaceous substances, with milk, afford sufficient nutriment in ordinary cases. If the previous health have been poor and the vital powers reduced, or if there be a complication, more sustaining diet is required. Stimulation by wine or brandy is needed in these cases.

The cough ordinarily requires treatment, inasmuch as the suffering of the child and loss of sleep are largely due to this symptom. Demulcent drinks, as flaxseed tea, infusion of slippery-elm bark, or the solution of gum arabic, are useful, to which, to render them more palatable, lemon-juice may be added. A small dose of Dover's powder or the mistura glycyrrhizæ composita of the U. S. Pharmacopœia, or, what I frequently prescribe, the *Syrupus contré la toux* of the French Pharmacopœia, relieves the severity and diminishes the frequency of the cough.

Since one of the most common and dangerous complications of measles is inflammation of the respiratory organs, local treatment directed to the chest is important if the bronchitis have more than the ordinary severity and the cough be frequent and painful. The chest under such circumstances should be covered by cotton wadding or thick flannel, over which, in cold weather, it may be best to apply oiled silk. Such applications increase the amount of eruption underneath, and a copious eruption tends to prevent the occurrence of capillary bronchitis and pneumonia. If the eruption be tardy in its appearance or indistinct, it is well to produce moderate counter-irritation over the chest by some gentle irritant upon the surface, as camphorated oil, to which in the older children one-fifth or one-sixth part of turpentine may be added, or the oleum caryophylli, 1 drachm, to oleum camphorati, 2 ounces, may be employed.

Bronchitis so severe as to be properly regarded as a complication, and

pneumonia, which commonly occurs from the extension of the inflammation from the bronchial tubes into the alveoli, may, if occurring in the first stage of measles, prevent the full and normal development of the eruption, or if occurring during the eruption they may cause its disappearance. Prompt counter-irritation over the chest, but not so severe as to vesicate or make the patient restless, is required in the treatment of these inflammations. Trousseau states that he has derived benefit in the treatment of bronchial and pulmonary inflammations from what he designates urtication. This is produced by stroking the chest two or three times daily with the nettle (*Urtica dioica* or *Urtica urens*). This causes a prompt and abundant eruption, and with a less amount of suffering than one would suppose. The fever abates, and the respiration becomes more natural in proportion to the amount of nettle-rash. On the second day the effect is less than on the first, and after three or four days, says Trousseau, no further irritation results from the nettle. A more convenient and, in my opinion, preferable local treatment is the application over the chest, anteriorly, laterally, and posteriorly, of a light and thin poultice of equal parts of pulverized ginger and flaxseed, or of 1 part of mustard to 16 of flaxseed, between two pieces of muslin, made so moist that it wets the hands in holding, and covered by oiled silk or muslin. Derivatives to the extremities are also of some use in these cases.

Severe bronchitis and pneumonia occurring in measles require stimulating expectorants, the best of which is ammonium carbonate. I frequently write the following prescription, which is useful both as an expectorant and a cardiac stimulant. Given in milk or after food is taken, it does not cause gastritis, as it sometimes does in young children when employed in too concentrated a form. The dose of ammonium carbonate should be 1 grain at the age of one to two years, and 2 grains between the ages of three to five years:

℞. Ammonii carbonat., gr. xvj to ʒss;
Aquæ puræ, f℥ij.—M.
Sig. Give one tea-spoonful in four or five tea-spoonfuls of milk every hour or two.

The chloride of ammonium, in double the dose of the carbonate, is sometimes employed with apparent benefit in these cases. Quinine to reduce the fever, and digitalis, strophanthus, or camphor as a heart tonic, are also very useful in these inflammations.

Any intercurrent disease complicating measles requires for the most part such treatment as is appropriate when it is idiopathic, but secondary diseases require sustaining measures more than primary. As a rule, the patient should be in bed during the complication, although it may continue days or weeks beyond the normal period of measles.

Constipation should be relieved by simple warm enemata of water containing a little soap, or sweet oil and castor oil. Irritating purgatives should never be employed, since they are likely to cause recession of the eruption, and, especially in warm weather, intestinal catarrh. Eclampsia seldom occurs if the child be warm and in bed. It is less dangerous in the commencement of measles than subsequently, for, occurring during or immediately after the eruptive stage, it probably indicates the beginning of some complication. The premonitions of eclampsia, such as restlessness, delirium, and sudden starting or twitching of the limbs, and eclampsia itself, should be promptly treated by large and frequent doses of bromide of potassium or sodium, or, if this treatment be not adequate, by sufficient doses or enemata of chloral. The importance of prompt and effectual treatment of this complication is apparent from the fact that it is sometimes fatal, as in the case related above. A foot-bath of warm water to which mustard is added, or, if the eruption recedes or is slow in appearing, a general warm bath, should also be employed in cases of eclampsia or when symptoms occur premonitory of eclampsia. Also in such cases it is proper to apply cold to the head, as a large silk or linen handkerchief frequently wrung out of ice-water to which a little vinegar or alcohol is added.

Epistaxis occasionally occurs, and within certain limits it may be useful, relieving headache, delirium, and cerebral congestion if these be present. But when protracted or profuse it should be arrested by plugging or compressing the nares or by the use of astringent injections. Endocarditis and pericarditis rarely occur in measles, but in measles in debilitated patients thromboses of the small vessels are more common than in any other infectious disease, producing patches of gangrene of the skin and subcutaneous tissue. At least good observers have attributed the gangrene which sometimes occurs in the vulva, distal portions of the limbs, and in the cheeks and gums (noma or cancrum oris) in cachectic cases of measles to the plugging of the vessels by thrombi. Rilliet and Barthez have published a table of 98 cases in which gangrene resulted from various diseases. In 49 of these the antecedent disease was measles, in 5 scarlet fever, 6 whooping cough, 9 intermittent fever, 9 typhoid fever, 7 mercurial salivation, and 5 enteritis. In 46 cases collected by MM. Bouley and Caillault the antecedent disease was measles in all but 5.

Since gangrene occurring in measles is eminently a disease of debility, all antihygienic influences should be removed and the most nutritious diet with tonics should be prescribed. The ferruginous preparations and bitter tonics are useful. The physician should endeavor to arrest the gangrene, accelerate detachment of the slough, and produce a healthy and granulating state of the surrounding tissues.

This is best effected by applying a highly stimulating, or even escharotic, agent to the inflamed surface underneath and around the gangrene. A large number of stimulating and escharotic substances have been employed in cancrum oris.

In the treatment of gangrene occurring elsewhere than in the cheeks, lips, gums, and adjacent parts—that is, in the extremities, genitals, neck, ears, or upon the trunk—it is perhaps best to incise and remove the gangrenous part with scissors, so far as possible without causing hæmorrhage, and dust the parts thoroughly with iodoform, or its modified form, aristol.

In the treatment of cancrum oris, or gangrene of the mouth—terms which are also applied to gangrene of the cheeks and gums when it extends to these parts—M. Taupin recommends, after removing a considerable part of the gangrenous substance with scissors or other instrument, the application of strong muriatic acid, and, when the slough is detached, of dry chloride of lime. Rilliet and Barthez advise the use twice daily of muriatic acid or the acid nitrate of mercury—a powerful and dangerous remedy unless largely diluted with water. Whatever agent is used, they recommend its application by a brush upon and around the slough, followed immediately afterward by the application of the dry chloride of lime, which neutralizes the acid. The gangrenous and adjacent parts are then thoroughly washed with water from a syringe. They also direct frequent ablution with water in the intervals of this treatment. After the slough has separated the escharotic is to be discontinued and the chloride of lime used alone. Dr. Charles West has also employed muriatic acid. He says: "In one of the cases that I saw recover the arrest of the disease appeared to be entirely owing to this agent, though the alveolar processes of the left side of the lower jaw, from the first molar tooth backward, died and exfoliated, apparently from having been destroyed by the acid."

In 1881 an epidemic of measles occurred in the New York Foundling Asylum during the attendance of Drs. O'Dwyer and Lee. The number of children affected with it was 165, and, since many of them were cachectic, we were not surprised that gangrene appeared as a complication or sequel in 7 cases. In a girl of three and a half years it occurred upon the upper jaw around the roots of the teeth; in two girls of four years it occurred upon the inside of the cheek and upon the vulva, but not upon the gums; in a boy of three years it attacked the lower jaw, destroying four teeth with their sockets, and the upper jaw, destroying five teeth with the corresponding portion of the maxillary bone, so that all the incisors and one canine were lost, as well as the cartilaginous portion of the nasal septum. Gangrene also occurred in the groin in this case. Another boy, of three and a half years, lost two incisors from gangrene of the jaw. The treatment by muriatic

acid was employed in these cases, and, according to the house physician, Dr. Kortright, there was no further extension of the gangrene in any of them after the first application of the acid. These 5 patients lived, except the first, who had broncho-pneumonia. The remaining 2 children, both of the age of four years, died of diphtheria and pneumonia before the treatment for the gangrene could be tested. One of them had commencing gangrene of the lower jaw, and the other of the soft palate. Since this epidemic in the Foundling Asylum carbolic acid has been employed as an escharotic in one or two cases in this institution, instead of muriatic acid, and with such a result as to encourage its further use as an escharotic and stimulant in gangrene.

The purpose in employing a strong escharotic, as undiluted muriatic acid or one of its equivalents, is to establish a healthier state of the tissues. It cauterizes and destroys whatever soft tissue it comes in contact with; but at the same time, unless carefully used, and sometimes with precautions, it exerts a strongly corrosive action on the teeth and jawbone. Therefore in gangrene affecting the jaw there is great danger that it will destroy the periosteum, and consequently increase the necrosis.

A safer, less painful, and in many cases successful treatment is that employed by many British and American physicians—namely, the use of escharotics diluted, or, if applied in their full strength, such as are least active and penetrating. Some employ from the first topical treatment which is astringent and stimulating, rather than escharotic, and they report satisfactory results. Dr. Gerhard believes that "the best local application is the nitrate of silver if the slough be small in extent; if much larger, the best escharotic is the muriated tincture of iron, applied in the undiluted state. After the progress of the disease is arrested the ulcer will improve rapidly under an astringent stimulant, such as the tincture of myrrh or the aromatic wine of the French Pharmacopœia."

The local treatment recommended by Evanson and Maunsell differs from that advised by any of the writers from whom I have quoted. A knowledge of this treatment, from which I myself have seen good results, will be best imparted by quoting from these authors: "The lotion which we have found by far the most successful is a solution of sulphate of copper, as employed by Coates in the Children's Asylum. His formula is as follows:

℞. Cupri sulphatis,	ʒij;
Pulv. cinchonæ,	℥ss;
Aquæ,	f℥iv.—M.

This is to be applied twice a day very carefully to the full extent of the ulcerations and excoriations.

The cinchona is only useful by retaining the sulphate of copper longer in contact with the edges of the gums. A solution of the sulphate of zinc, 1 drachm to 1 ounce of water, by itself or combined with tincture of myrrh, Dr. Coates found to be also useful in some cases.

A moment's reflection will show us that the foregoing treatment is preferable, provided that it is equally effectual in arresting the gangrene, to the treatment by the strong acids which are in common use, and the efficiency of which cannot be questioned. If, after employing the milder treatment two or three days, the gangrene continue to spread, strong muriatic acid, carbolic acid, or one of their equivalents should be cautiously applied by a glass rod or tube in such a way that it comes in contact with only the diseased surface. It should be immediately followed by an alkaline wash, such as a solution of sodium bicarbonate.

The gases arising from the gangrenous mass are not only highly offensive to others, but they are doubtless injurious to the patient, who is constantly inhaling them. To remove the fetor a non-irritating and harmless disinfectant should be frequently employed between the applications of the powerful agent designed to check the extension of the gangrene. Spraying the affected surface with Labarraque's solution 1 part to 10 of water, corrosive sublimate 2 grains to 1 pint of water, carbolic acid 1 drachm to $\frac{1}{2}$ a pint of water, or peroxide of hydrogen 1 part to 4 of water, is useful for this purpose. When the gangrene is removed and the granulations present a healthy appearance, the danger as regards the gangrene is past and convalescence is established. Then no energetic topical treatment is required. A mild, stimulating lotion, like the tincture of myrrh, as recommended by Dr. Gerhard, suffices, with the aid of tonics and nutritious diet.

In rare instances measles presents a severe and dangerous form from its commencement, being attended by a profound alteration of the blood, so that either hæmorrhages occur or the coloring matter of the blood (hæmatin) is effused under the skin. This type of measles has been designated malignant. Its symptoms from the beginning indicate a profound dyscrasia and prostration. The pulse is rapid and weak; the patient is delirious or anxious and restless or somnolent; the internal temperature is unusually elevated, although the extremities may be cool. The eruption has a dusky livid color, and as it fades in favorable cases, it leaves yellowish stains from the effused coloring matter of the blood, which is slowly absorbed. Keating has apparently demonstrated the abundant formation of micrococci in the blood in malignant measles. This form of measles requires for the most part the treatment which is appropriate for severe scarlet fever or diphtheria, but is very fatal under even the best treatment. The

inflamed surfaces should be sprayed every hour with peroxide of hydrogen, 1 part to 4 of water, so as to destroy all the microbes which abound upon these surfaces and in the muco-pus. The alcoholic preparations should be given freely, as one tea-spoonful of whiskey or brandy in milk every two hours or oftener. Iron is needed to improve the quality of the blood, and of the different ferruginous medicines perhaps the tincture of the chloride of iron acts as promptly and efficiently as any other. It should be given in hourly doses. If further observations confirm those of Keating, and the fact be admitted that microbes occur in the blood and tissues in malignant measles, whether they are to be regarded as a cause or effect of the disease, perhaps corrosive sublimate administered internally may be found useful, as it is believed to be in diphtheria, in consequence of its germicidal action. Nasal catarrh and otitis so severe as to require special treatment are not so common in measles as in scarlet fever. Schwartze says that 3 per cent. of the cases of otitis occurring in children originate from measles. Both the nasal and aural inflammations require the same treatment as when they occur in scarlet fever, and which has been detailed in the preceding pages.

RÖTHELN.

I HAVE made a careful study of all the cases of rötheln which have come to my notice since 1873. Hardaway, in his article on rötheln published in 1884, says: "American physicians were almost entirely ignorant of rötheln till within the last ten years, when they were made acquainted with it through the medium of a careful paper on the subject from the pen of J. Lewis Smith of New York." The paper alluded to was published in the *Archives of Dermatology*, Oct., 1874. Since as well as during the epidemic which furnished the material for this paper, I have recorded the history of cases when opportunity occurred, and my observations enable me to state that rötheln in itself is not fatal, and is even trivial if we estimate its importance by the danger or injury to the system which it produces. Nevertheless, complications sometimes occur which may be dangerous, and even fatal, and which therefore require prompt treatment. The complicating diseases which have been observed are quite numerous, among which we may mention bronchitis, pneumonia, pleurisy, enteritis, entero-colitis, colitis, icterus, stomatitis, rheumatism, meningitis, abscesses, miliaria, pemphigus, erysipelas, œdema, enlargement of the thyroid, otorrhœa, earache, and keratitis. The complications, therefore, so far as the comfort and safety of the patient are concerned, are much more

important than the primary disease. They require the same treatment which is proper when they occur under other circumstances.

If the temperature in uncomplicated rötheln reach 103°, and the patient be restless, 1 grain of phenacetin with 4 or 5 grains of bromide of potassium or sodium may be properly given every three hours to a child of three years, until the fever and restlessness abate. If fever sufficient to require treatment continue beyond the third day, it is probable that it is due to some complication which will be revealed by examination. Restlessness without marked elevation of temperature requires only the use of the bromide. Uncomplicated rötheln terminates so soon that it seldom causes any appreciable impairment of the general health. Still, in cities so many cases have poor appetite and are anæmic that tonics containing iron are often useful after the physician discontinues his attendance.

VARICELLA.

VARICELLA is usually so mild that the patient does well without medicinal treatment. Occasionally the eruption is very abundant upon the face, and the patient is disposed to rub or scratch it on account of the itching. This should be prevented, since the undisturbed vesicle causes no permanent injury to the skin, and disappears, leaving the features smooth; but a vesicle broken and rubbed by the fingers of the child may have such extension of inflammation that a dimple results. I employ for the purpose of relieving the itching of the face, forehead, ears, neck, and other cutaneous surfaces, frequent washing with the following:

R. Acidi carbolici,	ʒj;
Tinct. camphoræ,	f ʒij;
Aquæ puræ,	Oj.—M.

Sig. Apply when needed to relieve pruritus. It should not be used upon any of the mucous surfaces.

The eruption appears upon the buccal and faucial surfaces, upon the edges of the eyelids, and sometimes upon the mucous surfaces of the prepuce and vagina. In these localities it is at times painful, and when so, a 4 per cent. solution of cocaine can be applied by a camel's-hair pencil to the painful part. The eyes can also be bathed with a solution of boric acid, 1 drachm to 8 ounces, and the mouth and other parts, except the eyes, can be bathed with a soothing lotion, as—

℞. Acidi boric., ʒj ;
Sodii borat., ʒj ;
Bismuth. subnitrat., ʒiij ;
Aquæ puræ, f℥viij.—M.
Sig. Shake well before using.

The family can be informed that in two or three days these eruptions, which are painful, will begin to abate.

SMALL-POX.

By WILLIAM M. WELCH, M. D.

Prophylaxis.

Of all the measures employed to prevent the spread of small-pox, none is so important and efficacious as Jenner's great discovery. There is perhaps no single scientific fact better established than that vaccination, periodically repeated, is capable of effectually preventing the occurrence of that disease in man. In view of this fact it does at first sight seem strange that variola should continue to prevail in civilized communities; and, while nothing appears easier than to control the spread of this disease, or even to eradicate it altogether, yet there are difficulties in the way of accomplishing this end which seem almost insurmountable. These arise from various causes, but chiefly from individual carelessness or indifference about employing vaccination, from a want of unanimity of opinion with regard to its efficacy, and from the absence of a general law making it compulsory. I know that many conscientious citizens are opposed to enforcing vaccination by law, but as every unvaccinated person is liable to contract small-pox and disseminate the contagion among others, he should therefore be regarded in the light of a public enemy, and dealt with accordingly. Surely it is not an unreasonable position to assume that no person through ignorance or prejudice should be allowed to contravene the public welfare.

But in the absence of a statutory law requiring the vaccination of all persons, very much can be done in the way of enforcing the measure by restricting the privileges of the unvaccinated. For instance, satisfactory evidence of successful vaccination should be required of every child before admission into public and private schools and institutions for the care of children; no unvaccinated person should be allowed to serve as a soldier in the national army or navy, or in the State militia; and no unvaccinated immigrant should be allowed to land until vaccination has been performed.

In view, therefore, of the great importance of this prophylactic measure to the public, it becomes the duty of all municipal and State authorities to provide gratuitous vaccination for the poor, and, indeed, for all helpless children of improvident parents, no matter to what

class of society they belong. No expenditure of money should be spared by these authorities in order to protect their citizens against a disease so loathsome and fatal as small-pox. From a purely monetary point of view such expenditure is wise, for a single epidemic of this much-dreaded disease in a community may necessitate a greater outlay to care for the indigent sick alone than would be required to purchase the means of protection for that community for a decade of years.

If vaccination were universally practised, and repeated from time to time as circumstances required, there would be little need for other means of prevention; but as it is impossible to attain so desirable a result, recourse must be had to other prophylactic measures, and some of these constantly form quite an indispensable part of the preventive management of small-pox. When this disease appears in a community the chief aim should be to prevent the dissemination of the infection, and of the various means commonly employed to attain this end isolation of the patient is of chief importance. This can only be accomplished with any degree of certainty by having the case removed to a well-organized hospital; and, as it is manifestly improper to treat such cases in general hospitals, it follows that every city and large town should be provided, either temporarily or permanently, with a special place for the treatment of this disease in the event of its outbreak. Certainly, in every large city a permanent and well-equipped institution of this kind is a necessity. It should be located sufficiently remote from the thickly-settled parts of the city as to endanger no portion of the community, while at the same time it should be easy and ready of access. Indeed, the more accessible it is, and the more fully it is provided with modern improvements and comforts, the more willingly and cheerfully will patients consent to removal thereto. It should never be spoken of as a "*pest-house*:" most persons will consent to go to a well-regulated hospital, but to a "*pest-house*" never.

Of course a special hospital of this kind should be managed under strict quarantine regulations. No person, however well protected, should be allowed to visit a patient in the institution except under extreme circumstances, and then only after every possible precaution shall have been taken to prevent his carrying away the germs of the disease. The nurses and attendants should not be allowed to leave the hospital, nor come in contact with other persons, until they have had an antiseptic bath and have changed their clothes. In providing nurses and other employés for the hospital it need not be required that they shall have had small-pox, but they should invariably be revaccinated before entering on duty.

The hospital should be provided with closed ambulances for the transportation of patients. Private or public vehicles should never be used for this purpose. Indeed, this is regarded as so important a matter

that in some large cities in this country the use of any kind of public conveyance for carrying persons affected with small-pox is prohibited by law, and its infringement is made punishable by fine. Besides being closed vehicles, so as to guard as far as possible against the spread of contagion from the patients, the ambulances should also be comfortable. The pain and prostration from fully-developed small-pox require that persons thus afflicted should, when transported, be handled with the greatest care and caution, so that no additional risk to life shall be incurred in consequence of the transfer. Lest infection be spread by the ambulance itself, it should be disinfected and provided with clean bedding, blankets, etc. every time it is used. In order that the public may know the character of the disease it conveys, it should bear the name of the hospital to which it belongs.

Whenever a case of small-pox occurs in a family, the physician's first duty is to vaccinate promptly all members of the family who have never been vaccinated, and revaccinate all others without regard to the character of their previous vaccination. If this be done and the patient sent to the hospital, the disease may be prevented from spreading. When it is known that a person has been exposed to the infection of small-pox, it is advisable not only to vaccinate that person immediately, but to quarantine him for a period of fourteen days; which sufficiently represents the incubation period of variola. The latter purpose doubtless could be most effectually carried out in a place specially set apart for the care of such persons; hence every large city should, in the event of an outbreak of small-pox, improvise a quarantine hospital or station for the temporary detention of persons suspected of having received the variolous infection. Every such person refusing to be confined in this place should be visited daily by a medical sanitary officer for a period of two weeks, or until symptoms of small-pox appear, in which event the case should be immediately sent to the hospital for treatment. These precautionary measures are especially necessary among the poor, whose dwellings are always small and often overcrowded. So also in the larger places of habitation, where there is no suitable apartment for secluding the patient, such as hotels, boarding-houses, public institutions, and all dwellings connected with stores, the same constant vigilance and prompt action in regard to vaccination and isolation are necessary to prevent the spread of the disease.

If the small-pox patient is to be treated at home, every possible effort should be made to seclude him from all persons, excepting only such as are required to act as nurses, and they should be protected by recent vaccination. In selecting an apartment for the patient a room most completely separated from all other parts of the house is preferable; but when this is not practicable—which is usually the case

in the ordinary city residence—the uppermost room of the house should be preferred. It should be well ventilated, and, if possible, have an open fire-place, in which fire should be kept constantly burning. All unnecessary articles of furniture, such as drapery, upholstery, carpets, etc., should be removed. Every precaution in regard to cleanliness and disinfection of clothing, bedding, and everything in use in the room should be exercised, so that the danger of spreading the infection shall be reduced to the minimum. A sheet wrung out in a strong solution of carbolic acid, Labarraque's liquid, or some other disinfectant, and suspended across the doorway, may aid in preventing the infection from being disseminated to other parts of the house. While it is impossible to practise aërial disinfection in an apartment occupied by a patient, yet the common practice of placing chloride of lime or some other disinfectant about the room undoubtedly serves a useful purpose, and should be encouraged. If these agents do nothing more, they certainly aid in correcting the bad odors which arise, and thus render the atmosphere of the room more agreeable to the patient and his attendants.

So long as a dwelling is infected with small-pox the entire household should cease to associate with the public. The attendance of the well members at church and other public assemblages should by all means be interdicted. The children should be required at once to leave school, and should not be readmitted until the family physician or some qualified sanitary officer certifies that the sickness has ended, that the house has been thoroughly cleansed and disinfected, and that the danger of conveying the infection to others has ceased to exist. It seldom happens that it is necessary to close a school on account of an outbreak of small-pox in the neighborhood, or even among the pupils, since protection can be so easily and certainly secured from properly-performed vaccination and its timely repetition. Indeed, well-marked evidence of previous vaccination should constitute a prerequisite of admission of children into all schools, public or private. If this rule were strictly observed, school authorities would have but little to fear from the contagion of small-pox.

When small-pox makes its appearance in a house, the well members of the household should, as a rule, not be removed, except to a quarantine station or hospital. For if removed to another locality, and the disease should subsequently appear in any of them, a new centre of infection would be established. Better by far would it be to vaccinate or revaccinate all such persons, and have them remain on the premises under sanitary supervision. To depend upon them to practise self-denial of their personal liberty voluntarily for the welfare of the public would be trusting too much to the weakness of human nature; hence, doubtless, the best results would be obtained by furnishing reli-

able guards to enforce not only isolation, but also compliance with all other necessary precautionary measures. Unfortunately, this procedure, if properly carried out, would probably prove too expensive to be feasible when small-pox is prevailing in a community to any considerable extent; but it would be entirely practicable to deal with the first cases in this manner. Surely, no expenditure of money, however great, would prove more prudent and economical in the end than that made for providing the means of limiting the outbreak of the disease to the original case or cases.

Another means of restricting the spread of small-pox is to apprise the public of the particular locality where the disease exists, so that no one may unknowingly approach within infecting distance of the place. But how to do this without exciting unnecessary alarm is a problem not easy of solution. The plan adopted in some cities of placarding the infected house with a large and conspicuous poster is believed by many to serve a useful purpose, notwithstanding it frequently meets with much opposition. The latter fact, however, is suggestive that the plan might also prove useful as a means of forcing the consent of patients to removal to the hospital as an alternative. But whether this plan be adopted or not, the sanitary authorities should keep the premises under constant supervision, instituting daily visits by officers qualified and empowered to advise and direct the observance of all necessary sanitary precautions, and, if there be danger of non-compliance, to enforce the more arbitrary and restrictive measures already recommended.

Disinfection is a highly important prophylactic measure. The infection of small-pox is not only imparted to the atmosphere surrounding the patient, but to all articles which have been used by him or been near him. It clings to these articles for a variable length of time, and they are therefore not unfrequently the media by which the infection is conveyed to others. Disinfection consists in the complete destruction of the infecting agent or germs of the disease, and it thus renders infected articles innoxious. Fresh air and sunlight are, in a certain sense, disinfectants; at least, when infected articles are freely exposed to the atmosphere and rays of the sun for some time, the infecting principle becomes less and less active, and finally disappears. Therefore the house, and especially the room, occupied by the patient should be freely though cautiously ventilated. If the weather be cool, an open fire upon the hearth would contribute very much to the change of air in the room, and it would also consume much of the infected atmosphere.

Chemistry, however, furnishes the more speedy and reliable disinfectants, and it is upon such that we mainly depend for the destruction of the disease-germs. Some one of these chemical agents should be

brought directly in contact with all excrementitious matter from the patient, and with everything which has been used by him or been near him during the progress of the disease. All discharges, not excepting those from the mouth and nose, should be received into a vessel containing some such disinfectant as chloride of lime, carbolic acid, or bichloride of mercury. Under no circumstances should the excreta be allowed to flow into the sewer or be cast away without first having undergone disinfection. In country districts, where disinfectants may not be readily obtained, the discharges should be deeply buried in the ground in a locality where there is no danger of contaminating the water-supply. Every handkerchief, towel, and article of bedding and clothing used by the patient should be steeped for some time before leaving the room in a solution of 2 fluidounces of chloride of zinc or 4 fluidounces of strong carbolic acid to the gallon of water, and afterward boiled by themselves for half an hour or longer in plain water; all small articles, such as bits of linen, sponge, absorbent cotton, and the like, should be burned immediately; all utensils used for eating and drinking should be purified by boiling water; and, in short, nothing should be allowed to leave the room without having first been subjected to some form of disinfection.

The attendants should not be more numerous than the necessities of the case require. They should be carefully instructed in regard to the importance of cleanliness, disinfection, and isolation. Not only should they be instructed to exclude from the sick-room all persons not having authority to enter, but also all domestic animals, such as the dog and cat, as they are exceedingly liable to serve as conveyers of the infection.

The clothing of the attendants should be of such material as can be readily boiled and washed, and it should be frequently changed and subjected to this process. An attendant should not come in contact with other persons while engaged with the case. On leaving, either temporarily or permanently, a bath should first be taken, using freely carbolic-acid soap, and the hair should be washed with a weak solution of mercuric chloride. No clothing should be worn or carried away from the premises that has at any time been in the infected atmosphere, unless it has first been disinfected.

Physicians also should exercise care lest they may be the means of communicating the contagion. When called upon to attend a case of small-pox the physician should not remain in the infected atmosphere longer than is necessary to make a proper examination; the prescription may be written and advice given in another apartment. After each visit he should carefully wash his hands, face, and hair; his hands especially should be washed in some disinfecting solution. He should then expose himself for a considerable time in the open air before

visiting another patient. But if much time has been spent in the infected atmosphere he should certainly return home, wash again, and change his outer clothing. The clothing which is removed should be hung up in the open air for several hours. If the case be long and tedious, it would be advisable for the medical attendant to have his clothing disinfected after attendance has ceased, or even before, if necessary. It is not a bad plan, as suggested by some, for the physician to wear into the sick-chamber a long mackintosh, or even a linen duster, buttoned up to the chin, and to keep the garment hanging in the open air in the intervals of his visits. In hospitals, where there are many patients to be examined, and where he is required to spend considerable time in the wards, nothing short of a change of his entire outer clothing before leaving the institution would be advisable.

The isolation of a small-pox patient should be continued until all the scabs are removed, and even then he should not be allowed to associate with the public until he has had one or more antiseptic baths. Perhaps the most reliable antiseptic bath that can be given is one containing corrosive sublimate. Great care, however, should be taken that none of the solution enters the patient's mouth. The safest way to proceed in the use of such a bath is, I think, simply to sponge the body and carefully wet the hair with the solution (1 to 2000), and then have the patient freely bathed in plain water, with the use of carbolic-acid soap. A 5 per cent. solution of Labarraque's liquid also makes a very reliable disinfecting bath. After this he should put on clothing which has not been exposed to the infection, or, if exposed, has been disinfected, and he may then safely mingle with the public.

Inasmuch as the body of a person who has died of small-pox is capable of imparting the infection, some precautions should be observed in regard to it. For instance, the body should be thoroughly wet with a solution of corrosive sublimate (1 to 500), or with a solution of chloride of lime in the proportion of 6 ounces of the drug to a gallon of water, or with some other equally powerful disinfectant; besides, it should be wrapped in a sheet saturated with one of these solutions and buried at once. The preferable method of disposing of the dead from this disease is by cremation; but this method is yet perhaps too strongly opposed by public sentiment to be practicable. It is not advisable to transport the corpse a long distance or from one city to another for burial, but if this be really necessary, it should first be placed in a metallic coffin hermetically sealed. In its burial, it should be put at least six feet under ground, and should not be disinterred unless absolutely necessary, and then only under sanitary supervision. The vehicle used for conveying the body to the grave should afterward be disinfected. It is perhaps unnecessary to say that the funeral should by no means be public.

After the sick-chamber has been vacated, either by the recovery or death of the patient, every article of no great value which it contains should be immediately burned. Everything else which will not be injured by the ordinary operations of the laundry may be safely and cheaply disinfected by immersion in boiling water for half an hour. It should be remembered, however, that the water must be maintained at the boiling-point for that length of time. But if it be impracticable to subject such articles at once to the boiling process, they should be immersed for about four hours in some reliable disinfecting solution—such as mercuric chloride in the proportion of 1 to 2000, or carbolic acid 1 to 50—and subsequently boiled. Heavy clothing, pillows, hair mattresses, and other articles which cannot be boiled and washed should be hung up in the room and subjected to the influence of sulphur dioxide. This may be accomplished by burning in the room, after it has been made as nearly air-tight as possible, 3 pounds of sulphur to every 1000 cubic feet of air-space. After this, the room should remain closed from twelve to twenty-four hours, then be opened, thoroughly ventilated, and all surfaces, including that of furniture, washed with a disinfecting solution (chloride of lime or carbolic acid 1 to 50, or mercuric chloride 1 to 1000); afterward the floor and other woodwork should be thoroughly scrubbed with soap and water. The wall-paper, if there be any, should be well moistened with the carbolic-acid solution and scraped off and burned. Paper may be reapplied or the walls whitewashed, according to fancy. In addition to all these precautions, it is advisable to have the room remain unoccupied for three or four weeks, during which time it should be well aired.

For disinfection of outer clothing, carpets, bedding, and all articles which cannot be boiled, there is nothing superior to steam. The germs of small-pox will certainly perish if exposed for half an hour to this agent at a temperature of 212° F. There are, however, certain articles which would be injured by moist heat, and for the disinfection of these dry heat may be substituted. In this case a temperature of at least 230° F., and continued for two hours, will be required.

As most of these requirements would only be indifferently carried out by the average citizen, and as some could not be attempted at all for the want of proper facilities, it is evident that local sanitary boards should be vested with authority and provided with ample means to take charge of every house in which small-pox makes its appearance, and apply the necessary measures for the eradication of the infection. The work of disinfection should always be conducted by a properly qualified sanitary officer, and, as it is done in furtherance of public safety, the public treasury should supply the means. In every large

city, as has been so pertinently remarked by an experienced sanitarian,[1] some suitable place should be provided for disinfecting, without cost to the poor and at a nominal cost to the well-to-do, all portable articles, particularly such as cannot be conveniently or satisfactorily cleansed and disinfected at home, such as beds and bedding, woollen clothing, and the like. "Such articles," continues this sanitarian, "could then be removed, with due precaution, in a wagon specially prepared for the purpose; those of no value being burned in a furnace, and the remainder, after being cleansed and thoroughly disinfected by steam, dry heat, or by chemical agents, according to circumstances, returned to the owners. This plan will prevent serious embarrassment, and will ensure a more complete purification than can be expected under ordinary circumstances; and its general observance will unquestionably do much toward the preservation of the public health." In cities where this method has been adopted its benefits have been clearly proved.

In order to afford health authorities the earliest opportunity to apply any or all of the measures which have been indicated for restricting and preventing the spread of small-pox, every case of the disease should be promptly reported to them so soon as its nature is determined. In some municipalities the physician in attendance is required to give such notification—a requirement which, I think, is not unreasonable. Unquestionably, every practitioner of medicine should feel himself called upon to sustain the sanitary authorities in their efforts to prevent or stamp out a pestilential disease, and should willingly comply with any requirement whose object is the attainment of so desirable an end. Surely, no one who properly appreciates the dignity of his calling would connive at the concealment of a disease whose existence endangers the public health. It has been truly said:[2] "No obligation to the patient or his friends is required of the physician to keep the nature of the disease a secret; on the contrary, by so doing he lowers his profession and dishonors himself, in that he wrongs the public by pandering to the selfish interests of the few."

Treatment.

In the management of small-pox greater progress has been made in the direction of prevention than of cure. Since the general introduction of vaccination epidemics of this once widespread and fatal scourge have greatly diminished in frequency; hence opportunities for studying the course and treatment of the disease in the present age occur only periodically, and these periods are often widely separated. For this reason, doubtless, the current literature of medical science contains

[1] Wm. H. Ford, M. D., President Board of Health of Philadelphia, "The Preventive Management of Small-pox," *Medical News*, March 11, 1882.

[2] Ford, *loc cit.*

less in regard to the treatment of this than of most other infectious maladies.

The type of small-pox has also been very considerably changed by vaccination. Where this agent does not confer immunity from infection, it is still quite sure to exercise a more or less marked modifying influence over the disease, according as the period at which it was employed is near or remote. Cases of small-pox thus modified are known as varioloid, and they may assume various grades of severity—from the mildest form possible to that barely distinguishable from the unmodified disease. In the management of the milder cases but little is required besides the employment of hygienic measures; the severe cases of this class, however, demand very careful attention, and even then death not infrequently results. But even where the protective influence of vaccination seems to be entirely lost, there is often sufficient of this influence remaining to cause a slight abridgment in the course of the disease, and thus a severe case is often helped through to a favorable termination. It is therefore easy to understand how a certain drug, or some special method of therapeutics, may acquire an unmerited reputation in the treatment of post-vaccinal small-pox.

Unmodified small-pox has always been a very difficult disease to manage, and the treatment, of course, has varied greatly in different ages. One of the earliest methods of treating the disease consisted in placing the patient in a bed surrounded with red hangings, covering him with red blankets and a red counterpane, having him suck the red juice of pomegranates, and gargle his throat with mulberry wine. It is said that Prince John, son of Edward II. of England, was treated in this way, and that his medical adviser took to himself no small credit for having brought his royal patient safely through the disease.

Later on, the treatment was for a long time equally erroneous, although not governed by the same superstitious belief. It was the practice for centuries to bleed largely and repeatedly, to purge, to blister, to apply heating lotions, to administer heating drinks, and to do many other irrational things. Without reproaching in the least our ancestors, who did the best they knew, yet their method of treatment cannot be too strongly condemned, since measures so depressing must of necessity cripple the powers of nature and add to the malignancy and fatality of the disease. More recently we have come to a recognition of the important fact that small-pox in its fullest development is so exhausting in its effects as to tax to the utmost all reserves of vital energy, and that it is our duty to conserve by every possible means the vigor of the patient.

It must be admitted that there are as yet no drugs known to exert the slightest influence in either shortening or modifying the course of small-pox. In view of the light, however, which is now beginning to

dawn on the nature of infecting agents of all contagious diseases, it does not seem altogether visionary to believe that the time is approaching when we shall be able to introduce into the blood a chemical substance which will render it an unsuitable soil for the multiplication and growth of infectious microbes. Surely, it does not appear impossible that through the great and rapid progress now being made in pharmacology and therapeutics there will yet be manufactured for us such substances as shall possess the particular action desired. The great advancement made during the last few years in chemistry, by which the synthetical method of obtaining various complex products has been rendered possible, affords ground for hope that we shall yet be able, not only to combat more effectually the pathological processes of small-pox, but also to destroy or antagonize the cause of the disease itself. Until this new era arrives, however, we must be content with a treatment based on rational principles.

In order to consider in detail the treatment of small-pox it seems most convenient to divide the disease into its various stages, as follows: 1. The Stage of Incubation; 2. The Initial Stage; 3. The Eruptive Stage; 4. The Stage of Suppuration; 5. The Stage of Retrogression, or Stadium Exsiccationis; 6. Convalescence.

The Stage of Incubation.—The interval between the reception of the infecting agent of small-pox into the blood and the earlier manifestations of disease is usually unattended by symptoms. There is no doubt, however, that certain unknown processes take place during this period. It is very important to know whether anything can be done at this time to arrest or change these processes so as to prevent or modify the approaching disease. Drugs, of course, are powerless for this purpose. Is vaccination at this period capable of exerting any such influence? This question has been answered in both the affirmative and negative. Some have advanced the opinion that when the micro-organisms of variola have gained access to the circulation the subsequent introduction of the micro-organisms of vaccinia can have no other effect but that of accelerating the action of the former. This opinion is based on the assumption that the micro-organisms of both these affections are identical. Hence, the few who hold to this view denounce vaccination at this stage of variola as not only useless but harmful, claiming that it tends to precipitate and intensify the incubating disease. I need only say that this view is altogether theoretical, and wholly unsupported by experience.

From the clinical reports of those who have made extensive use of vaccination at this period of small-pox there seems to be some difference of experience concerning its efficacy. In commenting on this question Cursehmann says:[1] "Are we able to exert any influence on

[1] *Cyclopædia of the Practice of Medicine*, Ziemssen, vol. ii.

the disease in the early stage preceding the eruption? Is it possible in infected persons, during the stages of incubation and invasion, to cut short the disease or to modify its course? Many attempts have been made to answer these questions affirmatively, but as yet without much result. The first idea was vaccination, and this was employed by some in the ordinary way; by others subcutaneous injections of vaccine-lymph have been given, it is said, with good results. I must, however, advise great scepticism regarding these assertions. Of the subcutaneous injection of lymph I have no experience; but that ordinary vaccination during the stages of invasion and incubation cannot stay the disease has been proved to me by chance observations and direct experiments. On the contrary, I have seen, in cases in which vaccination was practised after infection with variola, vaccine pustules and small-pox pustules developed side by side. It is, in my opinion, very doubtful whether vaccination can even render the course of the disease milder.

The hypodermic use of vaccine lymph is certainly not entitled to any confidence as a prophylactic measure. Immunity does not result from the mere presence of the lymph in the blood, but from certain unknown processes which take place in the system in the course of true vaccinia. It is therefore evident that the vaccine disease must reach a certain stage of development before it is capable of exerting any prophylactic power whatsoever. I have had very frequent opportunities of witnessing that vaccination during the invasive or initial stage of small-pox is utterly valueless, and also that it is equally valueless when performed no longer than three or four days prior to the earlier invasive symptoms. The vaccine vesicles resulting from vaccination practised at this period, and the variolous pustules, will, it is true, develop side by side without the one exerting any influence whatsoever over the other. But Cursehmann's experience seems to warrant the inference that at no time within the incubation period of small-pox can vaccination be used with advantage against the approaching disease. If such is his experience, it certainly differs very greatly from my own. I have in numerous instances seen small-pox very markedly modified by vaccination performed at this period, and not unfrequently have seen it prevented absolutely. In order that protection shall be complete it is necessary that the insertion of the vaccine lymph should be made almost immediately after the reception of the contagium; but if made at a somewhat later date a modifying effect may be obtained. No part of the incubation period should be considered too late to make use of this remedy, since this period is sometimes prolonged beyond its usual limit, in which case a late vaccination may prove of value.

It is my opinion that vaccinia does not begin to exert its prophylactic power until the areola commences to form around the vesicle. At this time the mild febrile reaction, regarded by Jenner as a *sine quâ*

non in true vaccinia, becomes apparent. If this stage of the vesicle be reached before the patient shows any symptoms of small-pox, the disease may be entirely prevented; if not reached until after the febrile symptoms appear, but before the eruption occurs, it may modify the attack. Now, it is well known that in typical vaccinia the areola appears about the seventh or eighth day from the date of insertion of the lymph, and is at its height on the ninth or tenth day; and it is equally well known that the incubation period of variola is, in the majority of cases, of ten or eleven days' duration, and that the eruption does not appear until about three days later. This renders quite obvious the fact that vaccination, practised shortly after variolous infection has occurred, has an opportunity in point of time to exert more or less prophylactic influence against the incubating disease. While no inflexible rule can be laid down, yet it may be said in a general way that if vaccination be practised on the first or second day after the reception of the infection the protection may be perfect; and if employed between this date and the fifth day, it may be partial. But I would emphasize the fact that after infection has occurred, every day that is allowed to pass before resorting to vaccination is so much valuable time lost.

While the appearance of the areola generally indicates the period of the vaccine process at which its prophylactic power begins to be exerted, yet this period may vary somewhat in different individuals. For instance, I have more than once seen, say, two persons exposed to the contagion of small-pox at the same time, and in such a manner that there could be no doubt about infection occurring—have vaccinated these persons at once and with the same virus, and the vaccinia in both cases has pursued identical courses, yet in one case the protection was perfect, while in the other it was only partial. In other similar instances one received partial protection and the other none at all. This difference is doubtless due to some individual peculiarity that cannot be explained.

It is much easier to confer protection against small-pox after infection where revaccination is required than where the vaccination is primary. The explanation of this is not difficult. It is because vaccinia in its modified form—such as results from revaccination—develops more speedily, arrives at the areolar stage more quickly, and runs its entire course several days sooner, than does unmodified or true vaccinia; hence it is clear that the period of protection in such cases must be reached earlier. But as there is no uniformity in the course of vaccinia induced by revaccination, of course in that form of the disease in which the vesicle more nearly approaches the true standard the later in the vaccine process will the period of protection be reached.

In endeavoring to confer protection at this stage of small-pox the quality of the vaccine lymph employed has a great deal to do with

success. I have never been able to succeed well with animal lymph. It is too unreliable, and when it does succeed in inducing vaccinia the process is usually so slow that it does not reach the stage at which protection is exerted before the symptoms of small-pox appear. Nothing is of more vital importance at this period of the disease than that the vaccine virus employed should be fresh and active. The difference between succeeding and failing in producing vaccinia at this time often means to the patient the difference between life and death. I know of no virus that is more reliable or will give better results than eighth-day lymph taken directly from a typical vaccine vesicle on the arm of an infant. But as this virus can seldom be obtained when needed for this purpose, next to it I prefer humanized virus in the form of crust from a healthy infant; and I have a very decided preference for that which has resulted from a long series of human transmissions. There is no question that vaccinia induced by such virus runs a much shorter course than that which results from animal lymph, or even from virus of recent humanization. The vaccine in use in this country prior to the introduction of animal vaccination (in 1870) induced a decidedly modified type of vaccinia, whose duration, counting from the insertion of the virus until the falling off of the crust, was only fourteen or fifteen days. It is evident that vaccinia of this character is attended by a more speedy development of the vesicle and an earlier appearance of the areola than is the case in the more typical form of the disease, and consequently can be used with greater effect against incubating small-pox. I need hardly say that where time is not so important an element vaccine which produces the typical Jennerian type of vaccinia is greatly to be preferred, for I believe it confers protection of greater durability.

There is no doubt that the milder type of vaccinia, or that resulting from long-humanized virus, is capable of conferring complete immunity against small-pox for a variable length of time. The best prophylactic results that I have had from vaccination after variolous infection have been from the use of such virus, and I attribute this wholly to its reliable and speedy action. In using this virus it is advisable that a number of insertions be made, as this not only increases the chances of inducing the vaccine disease, but tends to bring the system more effectually under its influence. Furthermore, it is believed by some authors that multiple insertions quicken the processes of vaccinia, and thus hasten the attainment of that stage of the disease at which its prophylactic power begins to be exerted. Waterhouse was of this opinion, and his remarks on the subject are interesting because they were made nearly a century ago, in the very earliest history of vaccination. He wrote: "I think it proper to publish an important fact for which we are not indebted to Europe—namely, *If a*

person be inoculated with the kine-pock two days after having received the casual infection of small-pox, the kine-pock will predominate and save the patient. Nay, I will go further and say in some cases *three days* posterior to infection instead of two; for there is a mode of expediting the operation of the kine-pock virus by increasing the quantity of matter thrust under the epidermis; and it appears, from experiment, that this does not depend so much on increasing the quantity put into a deep puncture as it does on the increase of infected surface. In other words, you may expedite the processes of kine-pock inoculation two days, if not three, if, instead of two punctures, you make sixteen or twenty;" . . . . "and on the sixth day from the operation we shall have the appearance of the eighth day in ordinary cases; and on the eighth day we shall find the appearance of the tenth, and so on with the febrile symptoms, in which commotion the prophylactic power consists."

As there is nothing at this stage of small-pox of greater importance than vaccinia attended by prompt and speedy development of the vesicle, it is evident that the virus employed should be selected and used with the greatest possible care and skill. Humanized crusts are not all equally reliable and active, and it requires more experience and closer attention to distinguish between those which can be trusted and those which cannot than is generally supposed. In order to ensure success, it is advisable when possible to employ virus from more than one source. It is desirable at this time to guard as far as possible not only against failure, but also against a vaccine disease of slow progress. A tardy vesicle, or one that is slow in making its appearance and late in arriving at maturity, gives no assurance of safety. From the use of bovine lymph, especially that form which is now furnished in a dried state on ivory points, it is not unusual to find the vesicles two, three, or more days late in making their appearance, and correspondingly late in reaching the areolar stage. Such a vaccination of course could scarcely be expected to modify the approaching disease, much less prevent it.

It has been suggested by some that variolous inoculation might be practised with advantage where too great a length of time has elapsed since exposure to the contagion of variola for vaccination to be of any benefit. But besides the legal objection to such a procedure, there is often the difficulty of determining the exact day on which infection occurred, especially when the disease breaks out in a private family, and without this knowledge it would be impossible to say of any such case that it is too late to confer protection by vaccination. Perhaps I can best illustrate what I mean by citing one or two examples of vaccination after infection out of very many such recorded in my record-book. A mother and her four children were admitted into the small-pox ward of the hospital under my care; the mother was suffering

from small-pox, which had advanced to the seventh day of the eruption, while all the children were still in good health. Three of the children were unprotected by vaccination, and the other, a girl of eight years, had been vaccinated in infancy. All four of the children were at once vaccinated. The girl who had been vaccinated took vaccinoid, and enjoyed immunity from small-pox. The other three children developed regular vaccinia; of these, one was perfectly protected, another had an exceedingly mild form of varioloid, and the other, unfortunately, suffered from unmodified small-pox and died.

The very last group of variolous cases which, up to this time, has been admitted into the hospital illustrates not only the same facts, but also the fatal consequence of vaccination unsuccessfully performed when the contagion of variola is within infecting distance. The history of this group of cases is as follows: On April 28th a mother and her two children—one aged four years, and the other eight months—were brought to the hospital on account of the younger child suffering from confluent small-pox; the mother and the older child being still in good health. The disease in the younger child had advanced to the sixth day of the eruption; death occurred three days subsequently. The infection in this instance had been received from an adjoining house where the disease was prevailing. On account of the nearness of the contagion an attempt had been made to vaccinate both these children some four or five weeks previously to their admission, ivory points containing animal lymph having been used; but the only result obtained was spurious, consisting at the point of insertion in both cases of a small red elevation resembling a red raspberry. The mother had been vaccinated in infancy, and showed two good cicatrices, which rendered her immune against small-pox, and also against revaccination. The well child, aged four years, was vaccinated a few hours after admission, humanized virus being used. Three insertions were made, two of which developed into typical vesicles. On May 7th a few variolous papules—twenty-two by actual count—appeared. About a half dozen of these became very slightly pustular, but disappeared quickly, and without leaving any pitting whatsoever. Prior to the appearance of the eruption the temperature was for two or three days 101° to 102° F., but the child ate as usual, and played about the ward, being at no time ill enough to be confined to bed.

The sum of my experience in vaccination during the incubation stage of small-pox amounts to 159 cases. As the space at my disposal will not permit of anything like a detailed account of these cases, I can only refer to them in such a way as to show general results. The vaccinations were all primary, and were performed at various periods of this stage—anywhere from immediately after the reception of the contagium until within two days of the appearance of the eruption. As

the cases were all under observation in the hospital, where they came in the closest possible contact with numerous small-pox cases, there can be no question that the contagium was present in sufficient quantity to ensure infection.

Of the 159 cases, 29 were perfectly protected against small-pox; 14 almost perfectly protected; 20 protected to a well-marked degree; 24 partially protected; and 72 were unprotected.

In support of the statement already made—namely, that the vaccine disease does not begin to exert its prophylactic power until the vesicle has reached the stage at which the areola appears—I present the following statistics: Of the 159 cases, 57 were vaccinated on various dates ranging from one to seven days before the eruption of small-pox appeared, and of these 25 died, giving a death-rate of 43 per cent. In 102 cases vaccination was performed at an earlier period of the incubation stage, and of these only 14 died, giving a death-rate of 13 per cent. Of these 14 deaths, 11 occurred among persons who, before admission to the hospital, had been vaccinated with animal lymph, and the vaccine vesicles were, in most instances, of very tardy development. The value of vaccination during this stage of variola becomes still more apparent when these death-rates are contrasted with the death-rate of the unvaccinated cases, which amounted to 58 per cent.

The Initial Stage.—The initial stage of small-pox comprises the period between the earliest manifestations of disease and the appearance of the eruption, and has a duration usually of about three days. After what has been said of the power of vaccination after variolous infection, or of the hypodermic use of vaccine lymph, recommended by Furley,[1] it is needless to consider further either of these means as a remedy at this stage of the disease. Bloodletting, formerly so much employed, is now almost never resorted to, not even for the relief of symptoms. Quinine, in large doses, has been recommended as exerting a favorable influence over the course of the disease, but the experience of Curschmann and others shows that it possesses no such value. In short, all attempts to stay the disease, or even modify its course, have proved unavailing, and we can do nothing more at this stage than treat special symptoms as they arise.

The popular though erroneous notion of past centuries, that it is necessary to keep the patient hot and sweating, still prevails to some extent, and not unfrequently it is found very difficult to overcome this prejudice. On the contrary, every effort should be directed toward keeping the patient as comfortable as possible, and experience shows that a bed-room well ventilated and having a temperature of from 65° to 70° Fahr. is best suited to this purpose. The ordinary

[1] *Lancet*, May 25, 1872.

febrifuge mixtures, such as liquor ammoniæ acetatis, liquor potassii citratis, tinctura aconiti, etc., may be given in suitable doses and at stated intervals. I myself am in the habit of using the following formula:

℞. Spirit. æther. nitrosi,
Syrupi limonis, āā. f℥iv;
Liquor. ammonii acetatis, f℥v.—M.
Sig. Give 2 to 3 fluidrachms every two hours, in a little ice-water.

If there is irritability of the stomach, the effervescing citrate of potassium may be preferable. It sometimes happens that the stomach is very irritable, especially in children; in this case lime-water, subnitrate of bismuth, aromatic spirit of ammonia, a little chloroform-water, or any other drug or agent known to be of service in this condition, may be used. The swallowing of small pieces of ice will often give relief when everything else fails. When the skin is hot and dry and the temperature high, frequent sponging with cool water is serviceable. Severe headache may call for the application of cold water, iced compresses, or an ice-bag to the head. These measures need not be feared on account of the common impression that they tend to suppress the eruption, for such is not the case.

Nervous symptoms, such as insomnia, delirium, and convulsions, are often prominent features of the disease and demand appropriate treatment. Some one of the bromide salts, or chloral, given either separately or in combination, will usually succeed in subduing these symptoms. For the convulsions of children there is perhaps nothing more effective than chloral, given either by the mouth or rectum. When given by the mouth it should be well diluted, since it is very irritating to the throat, which is liable to become implicated in the variolous process quite early. Warm baths are also very useful. There is another nervous symptom commonly present at this stage of small-pox, and that is pain in the back. This is sometimes so distressing as to call for measures of relief. When the stomach is retentive Dover's powder may be given, or some one of the analgesic coal-tar products, now so frequently used to relieve pain, may be employed. Sometimes there is a good deal of restlessness and general irritability; in such cases I have found a little morphine, combined with the prescription given above, to act most happily.

The common practice of applying mustard to the back for the relief of pain or to the epigastrium to lessen gastric irritability cannot be too strongly condemned, since the variolous eruption always appears in much greater abundance on irritated surfaces. Wherever there is an

ulcer, a wound, or an excoriated condition of the skin, there the pustules are sure to be found in dense clusters. I have frequently seen the eruption intensely confluent over regions of the skin where a mustard plaster had been applied during this stage of the disease. Some have thought that the eruption might in this way be diverted from the face to other localities, but I am convinced that it is not diminished anywhere else by reason of its confluence on these parts through the action of a sinapism; rather is it increased to that extent.

The digestion at this stage is not vigorous; hence the diet should be light and easily assimilated. There is nothing perhaps more suitable than animal broths and milk. The best beverages are cold water and iced lemonade. Acidulated drinks seem to be particularly grateful to the palate. Gentle cathartics may of course be administered whenever indicated.

The Eruptive Stage.—The eruptive stage may be said to comprise a period beginning with the first appearance of the eruption and ending when pustulation has fully occurred. The duration of this stage in variola vera is usually about seven or eight days, but in modified small-pox it is shortened in proportion to the degree of modification. The great desideratum for this period of the disease is a remedy capable of diminishing or modifying the cutaneous manifestations, for there is no doubt that recovery of the patient almost always depends upon the quantity of the eruption and the length of time which it consumes in running its course. Formerly it was thought that some modification might be brought about by bloodletting, but experience shows that the most confluent eruption has succeeded to the most vigorous employment of the lancet. It is therefore worse than useless to bleed, for by so doing we expend that power which will be required later on to repair the injury done by the disease.

In order to control the course of the disease it is necessary to find some agent capable of antagonizing its pathogenic forces. Efforts have been made to accomplish this end by the internal and external use of various antiseptic or antizymotic drugs, and some of these have been vaunted as efficacious; but it must be truly said that no one of these drugs has as yet established for itself the claims put forth respecting its value. I have experimented with a few of the antiseptic remedies which have been highly recommended from time to time, but with results so discouraging as to lead at once to their abandonment. A few years ago I subjected 7 patients suffering from unmodified small-pox to the use of sulpho-carbolate of sodium, administering 20 grains every three hours: 4 of this number began taking the drug on the second day of the eruption; of these, 1 lived three days; 1 five days; 1 eight days; and the other fifteen days. Two began its use on the fourth day of the eruption; of these, 1 lived two days, and the other three

days. One began its use on the fifth day of the eruption, and in twenty-one days death occurred. It is seen that every one of these patients died. To be sure, they were all severe cases—all of them confluent, and some malignant. But they certainly represent a class of cases in the management of which something more than the ordinary treatment is required.

Besides the drug just mentioned, I have tried a few other antiseptic remedies, such as salicylic acid, salicylate of sodium, and carbolic acid; the latter both internally and externally. But I cannot say that I have seen any beneficial result from the use of any of these remedies. With xylol—which, according to Zülzer, coagulates the contents of the pustules and cuts short their development—I have had no experience.

The internal use of sulphur has been favorably mentioned as a remedy. From the fact that this drug is eliminated by the skin it has been thought that it ought to be peculiarly beneficial in the treatment of small-pox. Dr. Isear of France claims that he has used it with success, and recommends for children the following formula:

℞. Sulphur. lotum, ʒiiss;
Glycerini,
Aquæ aurantii flor., āā. fʒxv;
Syrupi simplicis, fʒviiss.—M.

Dose, a tea-spoonful every hour.

The local use of antiseptics in variola is also spoken of very favorably by some writers, particularly M. Bianchi, who reports excellent results from the following method: The patient is first bathed in a solution of 1:20 of boric acid, using with this bath antiseptic soap. During the course of the disease, baths in the boric-acid solution, or in a solution of corrosive sublimate 1:1000, are used every four hours. After each bath the patient is anointed with iodoform and vaseline, from 1 to 5:100, according to the severity of the case. When possible the pustules are opened with an "aseptic needle" and their contents evacuated. The patient is then wrapped in aseptic linen, which is frequently changed. It is claimed by the author that this treatment notably diminishes the duration of the eruption, lessens the fever, prevents severe ulceration and scarring, and thus leads to rapid convalescence. Similar results are said to have followed the use of baths containing permanganate of potassium, the salt being added until the water is of a rose-red color.

Corrosive sublimate has also been recommended locally in the form of spray. Talamon employs what has been styled, "the sublimate-ether spray," which I believe is prepared as follows:

℞. Hydrarg. chloridi corrosivi,
Acid. tartarici, āā. gr. xv;
Alcoholis (90 per cent.), ʒiss;
Ætheris, q. s. ad f℥iij.—M.

This is to be used by a hand-spray two or three times daily, and, as it is caustic, care must be taken not to throw it into the eyes nor in proximity to the nostrils of the patient.

Looking back over the literature of the subject, I find that the antiseptic treatment of small-pox just described is nothing more than the revival of an old practice which for many years was abandoned. It is true that when these agents were used a half century and more ago, it was not because they possessed antiseptic properties, for the germ theory was not then known; but this, certainly, could have made no difference in the results. As long ago as 1843, Gregory wrote:[1] "The latest mode of treating the surface during the maturative stage of small-pox is that of applying mercurial plasters containing calomel or corrosive muriate of mercury, or covering the whole surface with mercurial ointment. In the French hospitals at the present time the latter mode is in fashion. The reports which have reached me of its success, however, are not very flattering. I have seen all three plans fairly tried at the Small-pox Hospital. The ointment and calomel plasters were inefficient. The plaster of corrosive sublimate converted a mass of confluent vesicles into one painful and extensive blister, but I am still to learn what benefit the patient derived from the change."

Until some special treatment for small-pox is proved efficacious, we cannot do better than treat this stage of the disease on the same principle as the preceding one—by regulating the condition of the patient and giving attention to special symptoms as they arise. Usually it is not until the eruption appears that the disease is recognized and its severity prognosticated. If the case promises to be at all severe, all flannel under-garments should be at once removed, and the hair cut close, so that the head may be kept cool, cleanliness enforced, the risk of cellular inflammation of the scalp diminished, and a better opportunity afforded for the employment of cooling lotions should delirium or more urgent brain symptoms arise.

The febrile symptoms which usher in the disease now usually remit, but increase again as the eruption progresses. For this condition the remedies already mentioned may be employed. It sometimes happens in a depressed condition of the system, particularly in children, that the extremities and even the surface of the body are cool, and that the eruption is too slow in making its appearance. In such cases the application of heat and the administration of hot, stimu-

[1] Gregory on *Eruptive Fevers*, Bulkley.

lating drinks, such as hot toddy, may be of service. This condition in children is apt to be associated with convulsions, in which case there is nothing better than a warm bath, followed by an envelopment in warm blankets. Should the convulsions continue, however, chloral, by either the mouth or rectum, is quite sure to give relief. I repeat here the caution not to fail to dilute the chloral freely, for the throat is now so much involved in the variolous process that an irritating draught may give rise to croupous symptoms, or even acute œdema of the glottis.

As the eruption progresses, not only the throat but the soft palate, the buccal mucous membrane, the larynx, and sometimes the trachea, become more or less involved in the process, which is often the source of difficult and painful deglutition. This condition requires the use of mouth-washes and gargles, such, for instance, as those containing chlorate of potassium, boric acid, glycerole of tannin, tincture of myrrh, etc. I have often found the milder demulcent fluids made from flaxseed, gum arabic, or slippery-elm bark with water particularly palliative. Of these, none are more relished by the patient than flaxseed tea, sweetened with white sugar and acidulated with lemon-juice. Careful and frequent cleansing of the mouth affords considerable relief. This may be done by the nurse covering her index finger with a soft linen rag, dipping it into a little sage tea or solution of boric acid, and then thoroughly and carefully cleansing the entire buccal cavity. Sometimes it is found more convenient to use some of the mouth-washes mentioned above in the form of spray. All irritating washes, such as caustic solutions of nitrate of silver and the like, should be carefully avoided.

When the eruption assumes the vesicular form, there are always considerable burning and itching of the skin, particularly of the face, hands and forearms. For the purpose of preventing or alleviating these symptoms some ointment or oily substance may be applied. Vaseline containing about 3 per cent. of carbolic acid makes a very useful ointment; or, if the odor of carbolic acid be objectionable, oil of eucalyptus or thymol may be substituted. The preparation which I most frequently employ is one composed of equal parts of lime-water and olive oil, to which I sometimes add an antiseptic, and at other times a little cologne-water. This I have applied very freely with a large camel's-hair brush. When the burning and pain are severe there is perhaps nothing which gives so much relief as cold applications, such as cloths wet with cool water and spread over the face and arms. Curschmann believes that cold and moisture are the most efficient remedies for this condition. He says:[1] "In severe cases the application of iced compresses to the face and hands, or to any parts where the erup-

[1] *Loc. cit.*

tion is abundant, will diminish the severe pain, lessen the swelling and redness of the skin, and make the patient more comfortable."

The development of the eruption in the thick skin of the palms of the hands, tips of the fingers, and soles of the feet not unfrequently gives rise to intense pain. Cold applications or iced compresses may also prove of service, although I think I have seen greater relief follow the prolonged use of lukewarm hand- and foot-baths. The frequent application of flannel cloths wrung out in tolerably hot water, or the use of hot poultices, is often of great service.

Toward the latter part of this stage of variola persistent insomnia and violent delirium often occur. When this condition of the patient is attended by a flushed face and bounding pulse, an ice-bag to the head and a brisk cathartic may be of service. Tartar emetic and sulphate of morphine, in doses of from $\frac{1}{8}$ to $\frac{1}{2}$ grain each, will sometimes produce sleep and quiet the delirium. Large doses of bromide of potassium, or chloral freely diluted, may be given, and repeated if necessary. Some care, however, must be taken not to push these remedies too far, lest the patient lapse into coma or a state of profound prostration.

Occasionally, the delirium is of that violent kind which the older writers styled "*delirium ferox*." This is accompanied with a wild expression of the countenance, and such a strong tendency to escape from the attendant, or to self-destruction, that too much care cannot be exercised for the safety of both the nurse and the patient. I have known strong and muscular patients while in this state of mind to knock the nurse down, jump out of the window, and run to some secluded place, where they would cunningly secrete themselves. I have also known patients to attempt suicide in various ways while the nurse was temporarily absent. The necessities of the case, therefore, often require the use of some artificial means of restraint. For instance, a wide band of stout webbing or canvas may be placed loosely over the patient's chest and firmly secured to each side of the bed. Smaller bands of the same material may be fastened to each wrist and each ankle, the former being secured to the sides of the bed, and the latter to the foot of the bed, allowing, however, a little motion of the limbs, so that the patient shall not be subjected to painful restraint. In the mean time every effort should be continued to quiet the delirium, and when the patient refuses to swallow, the drugs and nourishment should be administered by the rectum.

It is deemed appropriate to speak of the treatment of hæmorrhagic small-pox under this head, for the peculiar manifestations of this type of the disease become strikingly apparent during the eruptive stage; and, moreover, it is rare for a well-marked case to live beyond the limits of this stage. Treatment is of little avail in this phase of

variola. The remedies usually employed are acids, quinine, ergot, and tincture of chloride of iron; but these, I think, are prescribed more in conformity with general usage than with the expectation of obtaining any real benefit. When hæmorrhage takes place into the various cavities or internal organs of the body, it is recommended that styptics be employed, together with injections of ice-water, or the use of cold compresses or tampons, although it is admitted that the beneficial effect of these agents is very slight. Transfusion has been tried, but has not given very encouraging results.

This type of the disease in varioloid is not quite so significant of danger as in variola. I have seen a few hæmorrhagic cases of varioloid in which the hæmorrhage from internal organs was not very profuse or protracted, although the spots of petechiæ and purpura were well marked, recover under the free use of iron and stimulants. In these cases nourishment was taken freely, prostration was at no time profound, and, as the patients passed favorably through the eruptive stage of the disease, the petechiæ and purpura gradually disappeared and convalescence became established.

The most appropriate diet during the eruptive stage of variola is a liquid or soft diet. It should be easy of digestion and very nutritious, for the patient has yet to pass through a severe ordeal, in which his power of endurance will be tested to the utmost. Such articles as animal broths, milk and eggs may be freely given. Bread may be added to the broths or to the milk, or it may be given in the form of milk-toast. In varioloid, the appetite during this stage is often unaffected; such patients require but little treatment, and may be allowed almost perfect freedom in choice of diet.

The Stage of Suppuration.—As the eruption advances from the papular form, it next becomes vesicular, and then from the admixture of pus-corpuscles the vesicles gradually grow more and more turbid until they become completely purulent; it is now that the disease enters the stage of suppuration. In variola vera this stage begins about the eighth day of the eruption, and continues until the eleventh, twelfth, or thirteenth, when desiccation commences. Its duration, therefore, is from three to five days. It is at this stage of the disease that the eruption attains its greatest development; that the suppurative, irritative, or so-called secondary fever occurs; that the mucous membrane of the mouth, fauces, and larynx becomes most dangerously involved; that the vital forces of the patient are put to the severest test, and his life is placed in the greatest jeopardy. The largest number of deaths by far occur during this period. The indications for treatment are to mitigate the fever, to disinfect the exudation from the skin, to relieve the dangerous throat symptoms, and to resist by every possible means the tendency to death from exhaustion. If the

patient's life can be prolonged through this stage, his chances for recovery increase with each succeeding day.

The febrile reaction, which had abated considerably when the eruption first appeared, now increases to a notable degree, often reaching a greater elevation than existed during the initial stage. In variola confluens the temperature at this period of the disease usually ranges from 103° to 106° Fahr. Various drugs and other means have been employed for the purpose of reducing the intense heat of the body, but none of them have given results entirely satisfactory. Quinine has been recommended, but in order to exert its antithermic properties it must be given in doses of 10 grains, repeated every half hour or hour until 40 grains have been taken. This usually produces effects so unpleasant that I seldom give it as an antipyretic. I use it, however, quite freely as a tonic, and also on account of its favorable action in preventing septicæmia. Some one of the antipyretics of the coal-tar series may occasionally be found useful. There is no doubt about the power of either antipyrine or antifebrin to reduce temperature, but I do not feel sure that the use of these drugs in all cases is unattended by risk. However, when used carefully and in selected cases I do not think the risk is very great. Of the two, I prefer antifebrin. According to my experience, a single dose of 10 grains of this drug to an adult causes, quite uniformly, when the temperature is high, a reduction of four degrees within four hours; but during the following four hours the temperature returns again to where it was before the drug was taken, and sometimes even runs a little higher. During this short respite from intense fever, however, the patient is often able to take a little more nourishment than he would otherwise do, and sometimes enjoys an hour or two of refreshing sleep.

Cool immersion baths, which have been recommended so highly in Germany for reducing high temperature in typhoid fever, have not met with anything like the same favor, even in that country, in the treatment of variola. Aside from the difficulty of getting a patient while in the pustular stage in and out of the baths, the latter, it is said, do not afford much relief. Cold compresses, and cool water squeezed from a sponge over portions of the body, are more easy of application, and are very often serviceable. I have seen patients temporarily benefited in warm weather by covering them with a sheet wrung out in cold water and renewing it every few minutes; but usually this treatment is not well borne for any great length of time, nor is it at all well borne in cold weather. Kaposi, I believe, recommends the application of cloths or compresses moistened with tepid water. The choice between the use of cool or tepid water should depend largely upon the season of the year and the sensations or temperament of the patient. Of course, during this treatment the clinical thermometer should be

used frequently in order to note the reduction of temperature that follows.

The topical applications recommended for the pustular condition of the skin are very numerous. To assuage the pain, burning, and itching, to correct the offensive odor, to guard against septicæmia, and to prevent pitting, are the principal ends aimed at in the selection of these measures. Remedies for the alleviation of the symptoms first mentioned need not be different from those recommended for the same symptoms in the preceding stage of the disease. Indeed, most of the local remedies already described, while they have no power to abridge the course of the eruption, nevertheless are among the best for any or all of the conditions above mentioned.

During the period of suppuration the sensation of itching is much more intolerable than the pain, so that it is almost impossible for the patient to refrain from scratching; and in consequence of scratching, or from other causes, the pustules become ruptured in many localities and their contents discharged. This purulent matter undergoes decomposition wherever it is found, whether in the soiled bedding and clothing or upon the skin of the patient, and consequently gives rise to a highly offensive odor. Remedies are demanded for this condition, not only because of its offensive character, but also because of its liability to lead to septicæmia. Antiseptic washes may be used, such as a solution of boric acid (1 : 20), of carbolic acid (1 : 100), or of corrosive sublimate (1 : 1000). I need hardly say that the latter should be used with some care, particularly about the mouth, nose, and eyes. A very convenient method of using such solutions is in the form of spray. The "sublimate-ether spray" already referred to may be of service at this time. A saturated solution of boric acid in rose-water may be used freely and without any fear of evil consequences, even if it should get into the eyes, nose, or mouth. I frequently employ a 5 per cent. solution of either carbolic acid or Labarraque's liquid, directing that both the patient and the bedding shall be sprayed with this solution every little while.

For attaining the same end, some one of the antiseptic oleaginous preparations recommended for the early stage of the eruption may be continued. I do not know of anything for this purpose to be preferred to the preparation composed of equal parts of olive oil and lime-water and a little carbolic acid or oil of eucalyptus (olive oil and lime-water of each ½ ounce, carbolic acid from ten to fifteen drops). This should be applied with a camel's-hair brush to the face, hands, and forearms two or three times daily. According to some authors, much relief and benefit have followed the use of an ointment made of lard and liquor sodæ chlorinatæ, in the proportion of 1 ounce of the former to 2 drachms of the latter. This is to be freely applied to the face and other much-

involved parts at short intervals. Very excellent results are said to have also followed the use of an unguent composed of 100 parts of cold cream to 4 parts of salicylate of sodium. M. Dujardin-Beaumetz reports that this ointment, in his hands, has not only been successful in destroying the repulsive odor in severe cases of small-pox, but has actually prevented suppuration. His method of using the ointment is to rub it over the face and other parts of the body where the eruption is most abundant; and, in addition, he advises that a powder of 100 parts of talc to 6 parts of salicylate of sodium be dusted over the affected localities. I have sometimes been able to lessen or modify the horrible odor by using as a dusting powder subnitrate of bismuth, boric acid, and, sparingly, iodoform. To either of these, and especially to the latter, talc might be added with advantage. I have not had an opportunity to test the more recent antiseptic, aristol; from the fact that it is odorless it is not improbable that it might prove more satisfactory than iodoform. I should think that from 15 to 20 parts of aristol to 100 parts of talc would make a very useful dusting powder at this stage of small-pox; or possibly it might be more useful in the form of ointment, if mixed with vaseline.

Various, indeed, are the methods which have been recommended for the prevention of pitting in small-pox, and yet I think it can be truly said that no one of them has stood the test of experience. From the unmodified form of the disease disfigurement is as great and as much dreaded at the present time as it was in the days of our ancestors, and it seems probable that this will continue to be the case until some agent is found capable of causing the eruption to abort before it reaches the pustular stage, for the suppurative process at this stage is attended with destruction of derm tissue, and consequently scarring must follow. If any ectrotic measure were reliable, how easy it would be to limit the amount of cutaneous inflammation, to lessen, if not prevent, the so-called secondary fever, and thus obviate the danger from exhaustion. Hence such a measure would serve a double purpose—that of saving life and preventing pitting.

Of the various ectrotic measures recommended, I shall refer only to those which have been spoken of most favorably. Opening the vesicles with a fine needle and evacuating the contents is a method advocated by Rayer. Also evacuation of the vesicles, followed by cauterization by means of a fine-pointed stick of nitrate of silver, has been highly recommended, especially by Velpeau, Bretonneau, and others. The exclusion of light and air from the skin has been thought to prevent pitting. The Egyptians and Arabs sought to accomplish this purpose by covering the face with gold-leaf; and others, more recently, by covering the face with certain dark-colored plasters. Collodion has had its advocates. If useful at all, I think flexible collodion

would be preferable. A solution of gutta-percha in chloroform has been recommended by such men as Stokes, Graves, and Wallace. In using either of the two latter preparations it is advised that they be applied to the face once or twice daily with a camel's-hair brush, and that the applications be commenced while the eruption is still papular or while the vesicles are quite small. These agents are supposed to act by excluding the air and by the mechanical pressure they exert. Tincture of iodine, applied in the same way and at the same period of the eruption, has been highly recommended. Sargent is said to have tested the ectrotic power of this agent in thirty cases of small-pox, the application having been limited to one side of the face. According to the description given of the results, there was not so much swelling where the iodine was applied, the vesicles were flattened, and, while the pitting was not prevented, it was perceptibly diminished. Lemaire and Sanson claim to have used successfully carbolic acid diluted with alcohol. This was applied as soon as the vesicles began to assume a purulent form. Certain merit has been claimed for subnitrate of bismuth and prepared chalk, in equal parts, when applied twice daily in connection with sweet oil. Sulphur ointment (from 1½ to 2 drachms to 1 ounce of lard), rubbed lightly over the affected parts three times daily, has been recommended as useful in preventing suppuration of the vesicles, and thus saving the skin from disfigurement. Mercury has perhaps been more highly praised than any other ectrotic remedy. It has been employed in different forms, both as a plaster and as a wash. M. Briquet was in the habit of using a mask composed of mercurial ointment and sufficient powdered starch to solidify the mass, so that it could be moulded to the various parts of the face. He renewed this application once or twice a day. The French physicians have been very partial to a compound mercurial plaster, known in the French Pharmacopœia as "plaster of Vigo." It has been claimed that if this plaster be applied over affected surfaces before the fifth day of the eruption, the papules either disappear by resolution or change into vesicles or tubercles. According to M. Briquet, the latter change seldom takes place except on the face. It is recommended that the plaster be kept on from eight to twelve days. When removed it is said that only small, hard excrescences are seen, and that these disappear in ten or twelve days without leaving any scars. It is admitted that ptyalism has been known to occur from the use of this plaster. Hence Bennett was led to substitute for the mercurial plaster calamine saturated with olive oil, which he found effective. A solution of corrosive sublimate (1 grain to 6 ounces of distilled water, with 1 drachm of laudanum), applied by means of compresses, is said to have caused the pustules to disappear without much ulcerative action. This application was recommended and used nearly fifty years ago. More recently

Niemeyer has recommended the employment of a solution of about the same strength (corrosive sublimate 1 grain to water 6 ounces). Skoda and Hebra advise that the compresses be dipped in a much stronger solution (grains ij–iv to water ℥vj). Still other measures have been highly lauded for this purpose, but I shall not consume time and space by referring to them.

The results which, in my experience, have followed the use of so-called ectrotic measures have by no means been encouraging. I have never seen any perceptible impression made on the eruption of variola from the application of mercurial ointment. The tincture of iodine, in my hands, has not only failed to do what is claimed for it by others, but, on the contrary, has aggravated the inflammatory action of the skin and increased the suffering of the patient. In the confluent variety of small-pox, where the liability to facial disfigurement is greatest, it is, of course, most unreasonable to talk about evacuating and cauterizing the vesicles. I have tried this plan in the mildly discrete form of the disease, and found that it gave some relief by lessening the sensation of tension that is commonly experienced in the locality of the pustules, but it did not prevent pitting. The application of collodion or a solution of gutta-percha in chloroform cannot, I think, be too strongly condemned. Such applications are objectionable in the first place because they form an impermeable coating, thus preventing exhalation from the skin, which adds to the discomfort of the patient. In the second place, they are objectionable because they render the surface of the skin over which they are applied so dense and unyielding as to cause an increase of pain in that part during the growth of the vesicles. In other words, the pain is increased by these agents on the same principle that it is rendered more intense in the soles of the feet and tips of the fingers when the eruption is developing there, where the skin is naturally hard and unyielding. Aside from all this, I would condemn these agents because they have utterly failed in my hands to accomplish the purpose for which they were used. This is not only true of collodion and gutta-percha, but of all other measures which I have employed. Hence, I feel about this matter of disfigurement very much as Gregory did when he wrote :[1] "There is no peculiar method which can be devised for the prevention of pits and scars. The masks and ointments formerly in use for that purpose, and so highly vaunted, are, in reality, more hurtful than beneficial. The application of a little cold cream to the hardened scabs is all that can be recommended."

The throat symptoms which appeared in the preceding stage of the disease now usually become greatly aggravated, especially in the confluent form of variola, where the eruption upon the mucous membrane of the mouth and fauces is generally also confluent. It is therefore

[1] *Loc. cit.*

necessary to continue the mouth-washes, gargles, and sprays previously recommended. It must be remembered that the eruption never presents itself on the mucous membrane so distinctly vesicular or pustular as on the skin, but assumes a pseudo-membranous or diphtheritic appearance. Hence the buccal surface and fauces often look as if they were covered by the true diphtheritic membrane. This condition may extend to the posterior nares, pharynx, and larynx, causing pain, fœtid breath, difficulty in swallowing, and sometimes all the symptoms of diphtheritic croup. The former symptoms may be benefited by using freely a solution of chlorate of potassium, alum, or borax as a mouth-wash or gargle. Curschmann recommends a weak solution of liquor ferri chloridi. When there is much fœtor from these parts some antiseptic, such as carbolic acid, permanganate of potassium, and the like, should be added to the mouth-wash or gargle. I have found diluted chlorine-water to answer a good purpose. If it be impossible for the patient to rinse out the mouth or use the gargle, the nurse should thoroughly cleanse the mouth and throat in the manner already described, and then apply to those parts an astringent or antiseptic spray. The nasal cavities should also receive similar treatment.

The pain in the throat and the difficulty of swallowing are often greatly benefited by having the patient hold in his mouth small pieces of ice and allowing these to dissolve slowly. Mucilaginous drinks, either warm or cold, are always grateful to the palate. As already stated, there is no drink of this kind more relished by the patient and more palliative than flaxseed tea containing lemon-juice. When the pain and swelling in and about the throat are intense, the application of the ice-bag externally is sometimes beneficial. On the contrary, some patients are benefited more by hot applications, such as poultices. Should acute œdema of the glottis or of the ary-epiglottic fold occur, an emetic may be given if the patient is not too weak to bear its action, or local scarification may be practised.

When the eruption is intensely confluent on the mucous membrane of the fauces and larynx, there is not only swelling of these parts, but the epithelial layer degenerates into a veritable false membrane, which resembles the pseudo-membrane of croup, and gives rise to all the distressing symptoms peculiar to that disease. The local treatment for this condition need not differ greatly from that usually employed in true diphtheria. In addition to some of the local remedies already recommended, inhalations of steam from boiling water or from water and vinegar mixed may be of service; likewise, the vapor from slaking lime is sometimes useful. Lime-water in the form of spray has been recommended. Also spray-inhalations of a solution of lactic acid in water (20 grains to 1 ounce) may be tried. I have seen in true diphtheria much benefit follow the use of peroxide of hydrogen, applied either in the

form of spray or with a camel's-hair brush. Possibly it might prove of service for this condition in small-pox. When suffocation threatens, either from this cause or from acute œdema of the glottis, tracheotomy offers the best if not the only chance for recovery.

The eyes often require attention at this period of small-pox. Ophthalmia in its more serious and destructive form, however, usually does not appear before the commencement of the retrogressive stage of the eruption, and sometimes even later. At this (the suppurative) period there is always a good deal of inflammation of the lids and lachrymal apparatus; the lids, indeed, are often so much swollen that they cannot be opened, and pus may be seen oozing from their margins. The nurse should be instructed to wipe away the pus as fast as it forms, and to apply to the parts frequently a saturated solution of boric acid and rose-water. Compresses wet with either warm or cold water may be kept constantly applied.

It is at this stage of small-pox that the vital forces of the patient are put to the severest possible test. The prostrating effects of the vast irritation and profuse suppuration from the innumerable pustules must necessarily be very great. Watson has estimated the quantity of pus thus generated as amounting to quarts. A drain upon the blood so extraordinary as this demands that the strength of the patient should be vigorously supported; otherwise evidence of exhaustion soon becomes apparent. The first evidence of flagging of the vital powers is often seen in the subsidence of the redness and swelling of the face and hands: the skin becomes pale, the pustules present a shrunk or collapsed appearance, and the pulse grows rapid and feeble. Other symptoms indicative of exhaustion are subsultus tendinum, general tremors, a dry tongue, and delirium. These are always indications for the most liberal use of stimulants and nutritious and easily-assimilated food. It is wiser, however, not to wait until the vital energies begin to flag before resorting to the supporting plan of treatment. As the patient approaches the suppurative stage of variola his strength should be preserved by constant reinforcement, so as to enable him better to encounter the struggle which is before him. Contrary to what was formerly believed, the sthenic condition in this disease is not to be feared; rather is it desirable.

In a pamphlet entitled *Variola; its Nature and Treatment*, prepared in 1856 and published a few years later by the late Dr. Andrew Nebinger of Philadelphia, the supporting plan of treatment in this disease is very earnestly advocated. The author severely criticises the practice, then largely in vogue, of confining the patient to a diet composed of gruel, toast-water, and panada, and recommends instead the most liberal use of stimulants, milk, and eggs. He strongly and wisely maintains that the constant aim of treatment should be to supply nutriment in sufficient

quantity to compensate the system for the loss it sustains through the suppurative process. This method of treatment he not inappropriately styles "compensative nutritive treatment." He advises that supporting measures shall be commenced as soon as the eruption assumes the vesicular character. In carrying out this treatment he has found no diet so useful and grateful to the patient, nor any which gives as little inconvenience in swallowing, as a combination of eggs, milk, whiskey, sugar, and ice. These he gives in the proportion of one egg well beaten, half a pint of milk, from a half to one ounce of good whiskey, and sugar and ice in quantities suited to the taste and desire of the individual, repeating this potion every two or three hours. He says: "I have frequently had patients take as many as twelve eggs, three quarts of good new milk, and eight ounces of whiskey daily for several consecutive days; and yet, with all this supporting and stimulating diet, this most excellent proteid or highly nitrogenized food, these poor fellows barely escaped sinking into the grave, some of them having had that peculiar feebleness and tremor which is always the unmistakable evidence of a breaking up of the vital forces—the threatenings of dissolution." He concludes this paragraph with expressions of positive conviction that many of his cases which recovered would have died under the old method of treatment.

There is no doubt that the treatment at this stage of variola should be of a highly supporting character. All authors agree to this. But, unfortunately, the majority fix the appearance of symptoms of exhaustion as the proper time for the commencement of supporting measures. This is often too late. Undoubtedly Nebinger is right in anticipating these symptoms by the early employment of stimulants and nutrients. It is my practice to commence with these measures at the beginning of the suppurative stage, or earlier if deemed necessary. The method of their employment is about as follows: To an adult suffering from the confluent variety of the disease I direct that there shall be given every twenty-four hours from 2 to 3 quarts of unskimmed milk, two to four eggs, and 6 to 12 ounces of whiskey; the latter being given usually in the form of milk-punch. The eggs should be well beaten and drank with the milk (a little salt being added), or they may be given in the form of egg-nog. It is important that the nutriment be given at short intervals, since patients can seldom take a large quantity at one time. It is also important that the stimulants and nutrients should be faithfully continued during the night, for many a patient, when greatly prostrated, has sunk beyond recovery during that time, especially between midnight and morning, for the want of these measures.

In selecting the diet and stimulants we should, of course, take into consideration the condition of the patient's stomach. If that organ should be very weak or disinclined to receive in sufficient quantity the

nutritive material just referred to, or if there should be a great repugnance to milk, as is sometimes the case, such articles as bouillon with eggs, a well-prepared beef-tea, nutritious broths, and liberal amounts of wine should be given instead. As a stimulant for patients in profound prostration Curschmann says a very good preparation is the Stokes cognac mixture:

℞. Cognac opt.,
Aquæ dest., āā. ℥xv;
Vitelli ovi, No. 1;
Syrupi, ℥vj.—M.
Sig. A table-spoonful every two or three hours.

I would suggest that this preparation might prove more efficacious if repeated more frequently.

In the way of drugs, quinine in tonic doses—2 grains every three or four hours—is, I think, of service at this stage of the disease. Digitalis seems to be indicated at times to steady the action of the heart, but if there be evidence of collapse or cardiac failure, carbonate of ammonium should be given in addition to the alcoholic stimulants. When the patient is very restless or suffers from insomnia, which not infrequently happens, anodynes may be cautiously given, either by the mouth or rectum, or hypodermically if deemed preferable. The delirium which is often most prominent during this stage should be treated in the manner already described. No more medicine should be given than is absolutely necessary, for the less the stomach is taxed with the ingestion of drugs, and the more entirely it is given over to the work of sustaining the vital forces and nutrition of the body, the better will be the chances for recovery.

The question of administering cathartics during this stage of small-pox is one of some importance. According to Gregory, one of the most remarkable disputes which ever occurred in medicine was on this very question. The Arabians strongly opposed their use; Sydenham never regarded them with any favor; Morton inveighed bitterly against their employment; but Friend, assuming the position of a reformer, advocated their free use, especially during the period of suppurative fever. About this time, it is said, a young nobleman fell ill with confluent small-pox, and Friend, together with two physicians who held to the opposite side of the question, were called to treat him, and, in the language of Gregory,[1] "The arguments in the consulting-room were long and stormy. The patient died, in spite of the purgatives which Dr. Friend's pertinacity had at length induced his colleagues to agree to. A paper war succeeded, and from words the parties came

[1] *Loc. cit.*

to blows. In June, 1719, Dr. Mead and Dr. Woodward met in Cheapside, drew their swords, and, after a few passes, Mead came off victorious. This display effectually settled the dispute, and purgatives are now as freely employed in the secondary fever of small-pox as in ague or typhus. They are of the greatest service when the skin is hot and dry, when a scarlatinal rash covers the body, or innumerable abscesses give evidence of the excited state of the cutaneous vessels."

I cannot agree with Gregory and others who recommend purgatives at this stage of the disease. My experience leads me to believe that the use of such agents is often attended with great risk. They are not only exhausting in their effects, but they temporarily interfere with the processes of digestion and nutrition; and such interference is often sufficient, especially when the life of the patient is, as it were, hanging in the balance, to decide the issues of the case unfavorably. When the bowels are constipated a mild laxative may be administered, or, what is preferable, a simple enema may be given.

The Stage of Retrogression, or Stadium Exsiccationis.—The stage of retrogression is characterized by drying of the pustules, lessening of the pain, diminishing of the swelling and redness of the skin and also of the involved mucous membrane. The eyes again open, the nasal passages become more patulous, swallowing is less difficult, and the countenance, in favorable cases, assumes a brighter and more hopeful appearance. This stage, in unmodified small-pox, usually begins from the eleventh to the thirteenth day of the eruption, and runs very gradually into the stage of convalescence. In cases somewhat modified it commences a little earlier. During the greater part of this period the same general treatment recommended for the preceding stage should be continued. When, however, the patient shows well-marked indications of improvement, the quantity of stimulants may be gradually diminished, and such articles as corn starch, milk-toast, soft-boiled eggs, cup custard, and the like may be added to the diet. Quinine and some ferruginous preparation, especially the tincture of the chloride of iron, are particularly valuable at this time.

The treatment required for the skin, especially during the early part of this stage, does not differ from that already described. If the peculiar offensive odor has not been noticed before, it is quite certain to appear and become very prominent now. It arises from an exudation of a yellowish, viscid fluid upon the surface of the pustules, and forms a rough coating. The antiseptic washes, ointments, or powders should of course be continued as long as this condition exists. These remedies, particularly the ointments, are also useful to quiet the intense itching which at this period takes the place of the pain.

Complications.—Complications in small-pox are very numerous.

and this is the stage of the disease in which they are peculiarly liable to occur. Of these, abscesses and more or less extensive phlegmonous processes are most common. The abscesses may be treated by warm fomentations, and they should be opened as soon as fluctuation is detected, especially when they occur in the scalp, as burrowing of the pus often takes place there very extensively. The washing out of the cavities of the abscesses with an antiseptic fluid serves a useful purpose. The phlegmonous processes may be combated by the usual local antiphlogistic remedies, such as cold compresses or lead-water and laudanum. The system should be well supported at the same time. Phlegmonous erysipelas is a very dangerous complication. Ordinary erysipelas is much more common and far less fatal. These affections are to be met by the usual remedies. Gangrene of the skin almost never occurs, except occasionally in the scrotum. I have seen a few cases of the latter, but have never known one to recover. The local use of antiseptic agents and a vigorously supporting internal treatment are perhaps the best that can be done for this complication. It is not advisable to attempt to remove the gangrenous parts until nature has effected their separation.

Corneal ulcer is not an uncommon complication. It often begins at the early part of this stage, sometimes a little later, and it may begin as late as the period of convalescence. The more destructive forms of this affection usually begin at the former period. It is not, as some suppose, the result of a variolous pustule on the cornea. I believe the eye possesses complete immunity from the eruption of small-pox. The first evidence of corneal ulcer is a little pain and slight redness in a certain part of the eye, usually at the margin of the cornea, and very soon an ulcer is formed. The ulcerative process is often very rapid—so rapid, indeed, as to destroy the entire cornea within forty-eight hours. At this stage of small-pox the eyes should be kept scrupulously clean, and as a precautionary measure a solution of boric acid (10 to 20 grains to rose-water 1 ounce) may be instilled in them once or twice daily. They should be examined frequently, and as soon as the ulcer appears I would recommend the use of the solid stick of nitrate of silver, which should be brought to a fine point and applied very delicately. Atropine in solution should then be instilled in the eye, and cold compresses applied. In spite of treatment, however, the ulcerative action often continues, destroying not only the cornea, but giving rise to perforation, iritis, and even suppuration of the globe. Anodynes may be required to quiet the pain, and the diet should be liberal.

The pleura and lungs occasionally suffer at this period of the disease. While an ordinary inflammation may occur in these parts, yet they seem peculiarly liable to a form of inflammation which, in the lungs, rapidly advances to purulent infiltration, and, in the pleura, to empyema. In

treating these affections the fact must not be lost sight of that the patient is already greatly exhausted by the primary disease; hence the treatment should be principally of a supporting character.

Inflammation of the joints is by no means the rarest of the concomitant affections which appear at this stage of small-pox. Like all other inflammatory processes in this disease, it strongly tends to suppurative action. Not infrequently, indeed, it seems to begin as a purulent synovitis. According to my experience, the elbow-joint suffers more frequently than any other. In the treatment of this affection no deviation is required from the ordinary surgical practice in such cases in general. The pus should be evacuated and the parts treated antiseptically. Recovery from this complication is very rare indeed. When there is simply painful swelling of the joints, accompanied with slight inflammation and effusion of serum, good results may follow the use of ordinary local antiphlogistic remedies.

Septicæmia and pyæmia occasionally occur at the end of the suppurative period. When we consider the extent of cutaneous surface which is so freely bathed in pus and ichorous fluid at this time, it is, I think, surprising that this complication does not occur more frequently. The treatment here need not differ materially from that generally recommended for these affections occurring under other circumstances. As might be expected, the most approved treatment is not followed by very satisfactory results.

Changes in the abdominal viscera sometimes occur as complications. Of these, intestinal derangement is most frequent. This generally assumes the form of persistent diarrhœa. So common, indeed, is this disturbance of the intestines that Sydenham speaks of it as "*variola dysenterica*." The ordinary remedies, such as opium, the astringent tinctures, and chalk mixture, will, in the majority of cases, succeed in quieting the bowels. Subnitrate of bismuth is also very efficient. Often, however, these remedies require to be given in full doses and frequently repeated.

Complications in the form of disease in some part of the nervous system are by no means rare at this stage of variola. We may also meet with suppurative otitis, caries of the bones of the ear, ulceration of the mucous membrane of the nose, bronchitis, and various other affections. All of these diseases should, of course, be met by the most approved medical and surgical treatment.

Convalescence.—The duration of the period of convalescence from this disease varies with the severity of the attack. In uncomplicated variola vera convalescence is usually completed in from four to six weeks after the earliest manifestation of the disease, making, therefore, the convalescent period itself of from two to four weeks' duration. When recovery takes place from the severer forms of small-pox, convalescence

is not only slow, but is often interrupted by the occurrence of various sequelæ, among which furuncles and a succession of small abscesses are most common. Their treatment requires the application of hot fomentations until suppuration is established, and then the free use of the lancet. When these furuncular processes are very numerous and continue to be reproduced for a long time, good results may be obtained from the administration of Fowler's solution of arsenic. This constant recurrence of boils constitutes, according to some writers, the "furuncular diathesis," and indicates a depraved condition of the blood; more especially is this true when these suppurative processes assume the form of deep-seated abscesses. The occurrence of these sequelæ, therefore, calls for the use of tonics, such as quinine and iron; for stimulants, especially the malt liquors; and for a liberal and nutritious diet.

While erysipelas may occur in the preceding stage of the disease, it is much oftener met with during convalescence. It is generally not very fatal at this time, but yields quite readily to the ordinary treatment, such as the internal administration of 30 drops of tincture of chloride of iron every three hours, and external applications of diluted lead-water, with the addition of a little laudanum. Other approved methods of treatment would doubtless prove equally successful.

Aphasia is sometimes seen as a sequela of small-pox. I myself have met with two or three such cases. This symptom evidently indicates that a certain part of the brain has sustained some damage from the variolous process. It may be the result of a circumscribed encephalitis. According to my experience, recovery from this sequela is very slow; indeed, several months may elapse before the power of speech returns to anything like its normal condition. As to treatment, tonics are certainly indicated. For the purpose of aiding in the removal, by absorption, of any inflammatory products that may exist in the brain, iodide of potassium or iodide of sodium may be given.

Another sequela of nervous origin sometimes met with is paralysis. This symptom, I think, is more frequently seen in the extremities, especially the lower extremities. The source of this trouble is believed to be in the spinal cord. According to Curschmann, Westphal has shown that the paralysis is often due to numerous circumscribed foci of inflammation in the gray and white matter of the cord. Assuming this to be the cause of the malady, it is of course too late to treat at this time the acute inflammatory attack, for that stage has passed, but rather have we to deal now with its results. The aim of the treatment should therefore be to restore to a normal condition the diseased foci in the cord by favoring resolution of the inflammatory changes. For this purpose ergotin, belladonna, or iodide of potassium in appropriate doses may be given, while externally we may employ derivatives, such, for instance, as painting the length of the spine with tincture of iodine,

etc. When improvement begins, it may be hastened by the use of the galvanic current.

The diseased area within the spinal cord may sometimes be favorably influenced through general stimulation of the tissue-changes and of nutrition; hence any agent that tends to increase this function of the body is of service. We should therefore give tonics, such as iron, quinine, and strychnine, and even cod-liver oil when indicated; we should direct the patient to bathe frequently, to live as much as possible in the open air—preferably in the air of mountains and woods; in short, we should direct him to make use of every possible means that will increase his appetite and strengthen his digestion, while at the same time he should be supplied with a strong and abundant diet.

Œdema of the feet and legs is not infrequently seen after severe attacks of small-pox. In such cases there is always great exhaustion, and the patient is generally anæmic. The latter condition is doubtless the cause of the œdema in the great majority of cases. If there be chronic nephritis, the dropsy may be due to that disease; but nephritis is a rare sequela of small-pox. In the treatment of the anæmic cases iron, in some form, should be administered, and a roller bandage applied to the feet and legs. If the kidneys be diseased, of course they should receive appropriate treatment.

During convalescence from the severer forms of small-pox, night-sweats are often profuse and exhausting. The mineral acids seem to be indicated for this condition, or belladonna or atropine may be given. The latter often proves very efficacious.

Decrustation, when slow in taking place, may be hastened by free inunctions of glycerin or cosmoline, and by the daily use of warm baths. After the scabs have fallen off, deep and unsightly scars remain in the cutis vera, but we are powerless to remedy that condition. But when, in addition to the scars, warty nodules remain on the face, their removal may be hastened by painting them once or twice a day with tincture of iodine.

When convalescence is not interrupted by the occurrence of sequelæ, no internal medicaments other than ordinary tonics are required. The patient's appetite is generally very good—often, indeed, voracious—and he rapidly regains both flesh and strength.

TYPHOID FEVER.

By FREDERICK P. HENRY, A. M., M. D.

A FULL discussion of the treatment of a disease, especially if it be of protracted course, must involve the questions of prophylaxis, complications, and sequelæ, bearing in mind the fact that a complication is to be distinguished from an intercurrent affection. The latter is something accidental—*i. e.* no more liable to happen to a patient affected with a given disease than to one not so affected—while a complication is a disease or a process secondary to, and more or less dependent upon, another.

PROPHYLAXIS.

Under this head might properly be included all that concerns the treatment of typhoid fever, for the object of prophylaxis is not only to confer immunity from infection, but to prevent complications; and any method of treatment which surely accomplishes the latter indication leaves little or nothing to be desired. For example, certain tissue-degenerations in typhoid fever are generally believed to depend upon long-continued pyrexia, and, in the opinion of many therapeutists, if these are prevented the disease will almost invariably pursue a benign course. An antipyretic or refrigerant treatment is, from this point of view, curative, because it is prophylactic. It is usual, however, to limit the domain of prophylaxis to the prevention of infection; and this custom, although one which would be "more honored in the breach," will not be departed from in this article.

It is unnecessary to enter into any detailed argument to prove the infectious nature of typhoid fever. The fact of infection is generally admitted, and necessarily implies an infecting agent. The researches of Eberth and Klebs have demonstrated the latter to be a species of bacillus distinguished by certain peculiarities, chiefly of staining, from the *Bacillus coli communis* and other micro-organisms indigenous to the intestinal canal. This bacillus is found occupying the site of every lesion of typhoid fever—in the enlarged and ulcerated plaques of Peyer; in the tumefied mesenteric glands; in the spleen, the liver, the kidneys; in the ulcerations of bed-sores; and, finally, in the blood itself. It is true that the crucial test of the specific nature of this

organism—its successful inoculation in animals—is as yet wanting, but this objection may be met by the statement that we are acquainted with no animal, unless it be the horse, which is susceptible to typhoid infection. The latter animal is subject to a disease attended with marked congestion of the intestinal mucous membrane, and sometimes even with ulceration of Peyer's patches; but the enlargement of these follicles is never so great as in the typhoid fever of man, neither does it present the well-known appearance of "medullary infiltration." The general course of the disease, especially as regards the nervous and intestinal symptoms, is not unlike that of typhoid fever, but the affection cannot be regarded as identical until the bacillus of Eberth has been shown to be common to both.

The same criticism applies to the morbid process produced in the rabbit and guinea-pig by the inoculation of fluids derived from the lesions of typhoid fever. In these animals the alterations of Peyer's patches so characteristic of typhoid fever may be produced by such inoculations, but the same results follow the inoculation of various species of bacteria, and are, in fact, nothing more than one of the lesions of septicæmia experimentally induced.

For the complete demonstration of the specific nature of the typhoid bacillus we must therefore await the results of further research, possibly until an animal is found which does not possess immunity against what may be called spontaneous as distinguished from experimental typhoid fever. In the mean time, however, the evidence of the specific nature of the organism in question is convincing to those best able to form an opinion in such matters. Among the facts of which this evidence is composed may be mentioned the presence of the bacillus in the system during the febrile period, and its disappearance during convalescence, as well as its presence in drinking-water in many epidemics of the disease.

A question of great interest from a prophylactic point of view is whether the bacillus normally existing in the colon, the *Bacillus coli communis*, may outside the body become converted into the specific bacillus of Eberth. This question is by no means chimerical, and has already been discussed by the author in another publication.[1] I cannot give a better presentation of the facts in its favor than by quoting the article to which I refer:

"Probably the bacteriological question of greatest practical interest is whether an organism may be benign in one locality and malignant in another; or, to state it differently, whether the property of infection is an adventitious one, depending upon the soil in which the organism grows, or inherent in its substance. An attempt to solve this problem, in so far as it relates to the typhoid bacillus, has been made by Rodet

[1] *The Medical News*, March 22, 1890.

and Roux,[1] whose researches have led them to conclude that the bacillus of Eberth is nothing more than a modification of the *Bacillus coli communis*. The facts upon which they base this opinion are of two kinds: In the first place, they made cultures of the blood of the spleen and of the fæcal matters of two typhoid patients, and found that the former produced nothing but the bacillus of Eberth, and the latter little else than the *Bacillus coli communis*, the bacillus of Escherich. In the second place, according to Rodet and Roux, the optical points of resemblance between the two bacilli are greater than those of difference, and are such as to warrant the belief that the one is a modification of the other. Carefully-conducted cultures in gelatin, potato, and bouillon exhibit similar microscopic appearances, while the limits of temperature within which the two organisms can be cultivated are almost identical, being somewhat higher (46.5° C.) in the case of the bacillus coli than in that of Eberth's bacillus (45° C.)."

Under the microscope the differences are more marked, the bacilli coli being of almost uniform length, homogeneous in structure, slightly mobile, and staining readily, while the bacilli of Eberth are of unequal length and thickness, are more mobile, and stain less readily than the bacilli coli. The structure of their protoplasm also is evidently not homogeneous.

If, however, the bacillus coli be cultivated at a temperature of 44° to 46° C., it undergoes such changes as to cause it to bear a remarkable resemblance to the typhoid bacillus. The rods become of unequal length; their protoplasm ceases to be homogeneous, and presents a series of readily-staining condensations, separated by clear intervals; in a word, the results of numerous observations of the sort show that while the type of Eberth's bacillus is relatively fixed, that of the bacillus coli is remarkably unstable, and by a series of transitions approaches, and even becomes identical with, the former.

The typhoid bacillus is, according to the authors quoted, the bacillus coli in a state of degeneration. This is shown by the fact that the former is less able to resist heat than the latter, Eberth's bacillus being destroyed by a temperature (80° C.) which is supported by the bacillus coli. This is far from saying that the bacillus which causes enteric fever is in a state of degeneration at the time of infection. The bacillus coli becomes virulent without any notable change in its appearances and other characters, and it is in the interior of the organism, especially in the spleen, that it assumes the features of Eberth's bacillus. The latter are the result of the destructive forces of the body.

The practical conclusions from these researches are twofold:

1. Water contaminated with fæcal matter, not necessarily typhoidal, may give rise to enteric fever.

[1] *Comptes-Rendus hebdomadaires des Séances de la Soc. de Biologie*, Feb. 21, 1890.

2. The tolerance of the organism for the bacillus coli shows that the latter acquires its virulent features outside of the body.

It is to be hoped that the experiments of Rodet and Roux will be thoroughly investigated. Certainly, none more practical could engage the attention of bacteriologists. If confirmed, the term "pythogenic fever," introduced many years ago by Murchison, may yet be generally accepted as the proper one for the disease which is now somewhat vaguely styled "typhoid" or "enteric fever."

I have given the foregoing details on account of what appears to me their marked bearing upon the prophylaxis of typhoid fever. In the present state of our knowledge of this subject it seems to me imperative not only to disinfect the excreta of typhoid-fever patients, but also those of the healthy, or at least so to dispose of them as to make it impossible for them to contaminate the air we breathe or the water we drink.

The chief—in the opinion of many practical physicians the only—source of the typhoid infection is the excrement of those affected with typhoid fever. There are few who believe, with Laveran,[1] in the direct transmission of typhoid fever from patient to patient. The experience of most hospital physicians coincides with that of Andral, who never observed an instance of the sort. In justice to Laveran, it must be remarked that with reference to this point he draws a distinction between civil and military hospitals. In the former, as he justly observes, many of the patients have either passed the period of greatest susceptibility to the disease or have already suffered from it. In military hospitals, on the other hand, the patients are young men, mostly from the country,[2] in other words, far removed from the centres of epidemics, and therefore peculiarly susceptible to the typhoid infection. Among such patients Laveran, up to 1884, had observed twenty-eight cases of typhoid fever originating in hospital wards, and, as he believes, by direct transmission from patient to patient.

Dujardin-Beaumetz is still more positive in the expression of his belief in the direct contagion of typhoid fever, and speaks of it as of daily occurrence.[3]

Conveyance of Typhoid Infection by Water.—The ordinary vehicles of the typhoid infecting agent are water, air, the soiled linen of typhoid patients, and the hands of their nurses. In the great majority of cases—according to Brouardel, ninety-nine times in one hundred—the disease is conveyed by drinking-water. The most interesting and convincing examples of the latter mode of propagation are

[1] *Bulletin et Mémoires de la Soc. méd. des Hôpitaux de Paris*, tom i. ser. iii., 1884, p. 75.

[2] This statement applies to the military hospitals of France, in which Laveran's observations were made.

[3] "Il ne faudrait pas cependant être exclusif et rejeter la contagion directe dont nous voyons journellement des exemples dans nos hôpitaux, soit dans le personnel, soit parmi les élèves" (*Leçons de Clinique thérapeutique*, t. iii.).

furnished by cities which obtain their water from more than one source. Such a city is Geneva, the water-supply of which is derived from the Rhone and the Arve. The former issues from the Lake of Geneva in two branches, of which one, the left, was dammed for hydraulic purposes in February, 1884, the effect being to divert the outlet of the lake entirely into the right branch, from which drinking-water for the city was pumped. On January 28th a portion of the lake, not far from its outlet and near the openings of certain sewers, was dredged. This was followed about twenty days later by a severe epidemic of typhoid fever, the number of cases rising from 18 in January to 965 in March. The dredging ceased on March 4th, and fifteen days later —*i. e.* at the end of a period equal to the incubation stage of typhoid fever—the epidemic began to decline. It did not definitely cease, however, until the month of August, when a conduit was carried into the lake far from the sources of pollution, and became the sole source of water-supply so far as the lake was concerned. The epidemic was closely studied, and among other facts it was ascertained that in the quarter of the city (Quartier des Eaux-vives) adjoining the portion of the lake which was dredged there had been, during the latter months of 1883, 7 cases of typhoid fever. During the epidemic not a single case of typhoid fever occurred among those who were supplied with water from the Arve.

The following experiment, described by Chantemesse and Vidal,[1] is of decided interest in connection with the origin of this epidemic:

In a flask is placed a small quantity of sand and earth. It is then filled with water sterilized by boiling, and, after cooling, cultures of the typhoid bacillus are added. For a few weeks after this procedure cultures of the bacillus may be readily obtained from the upper layers of the water. Gradually, however, the depth from which these are procured increases, until at the end of two months, the flask having remained perfectly quiet, the water is entirely free from germs. If it be now carefully decanted and fresh water poured in, so as to stir up the sediment of sand and earth, it will be found teeming with bacilli. Such experiments and such epidemics as that of Geneva in 1884 might lead one to suggest that the Scotch proverb, "Let sleeping dogs lie," be paraphrased so as to read, "Let sleeping microbes lie."

Paris is another city the water-supply of which is derived from more than one source; in fact, it is remarkable for the number of the streams which it lays under contribution for this purpose. Unfortunately, they are not of equal purity. The Dhuys and the Vanne give the best water, but occasionally have to be supplemented by the Seine, the Marne, and the canal of Ourcq, the three latter being polluted by sewage before their entrance into the city. This fact is so well known

[1] *Gazette des Hôpitaux*, No. 26, 1887.

that official notice is always given before turning on the water from the last-named sources in any district of the city. The invariable result of such an addition to the ordinary water-supply is a marked increase of the cases of typhoid fever. For example: About July 20, 1886, the river-water (Seine and Marne) had to be levied on to supplement the deficiencies of the Dhuys and Vanne. From the 18th to the 24th about 40 cases of typhoid fever were admitted into the various hospitals; from the 1st to the 7th of August 150 were admitted. In January, 1887, the river-water was again turned on, and the number of admissions augmented from 30 in January, to 95 in March, the supply of river-water having been continued during that interval. In June of the same year the use of river-water ran up the number of weekly admissions from 20 in the last-named month to 165 in August.

The last instance of the conveyance of typhoid fever by drinking-water to which I shall allude is, in many respects, the most remarkable on record, and chiefly because of the numbers attacked—1200 out of a population of 8000—and the accuracy with which the origin of the epidemic was traced to the dejections of a single patient. The town of Plymouth, in Luzerne county, Pennsylvania, was the seat of the epidemic, which was carefully investigated by Drs. French and Shakespeare,[1] who were appointed for this purpose by the mayor of Philadelphia on May 7, 1885. Omitting many interesting details, I will merely state that the town of Plymouth is supplied with water from three sources: 1, a mountain-stream, in the course of which are four reservoirs formed by dams; 2, the Susquehanna River; 3, a "great number" of wells. It was positively demonstrated that the victims of the disease were to be found solely among those whose drinking-water was obtained from the first-mentioned source. The reason of this selection is fully set forth in the following extract from the report of Drs. French and Shakespeare: "It may be well, however, to state here that it has been shown that the three lower reservoirs on the mountain-stream which nine months of the year supplies Plymouth with water were on the 20th of March nearly empty; that in a dwelling on the sloping bank of the stream, a little distance above the third reservoir, and within seventy feet of the bed of the brook, there was a case of typhoid fever, running its course through January, February, and March; that during most of this period the ground was frozen and covered with snow; that during the illness of this patient the evacuations passed in the night were habitually carried out and thrown upon the snow toward the stream, *no attempt at disinfection having been made;* that about the 25th of March a thaw began and was followed by slight rains; that on the 26th of March the superintendent of the

[1] *Report on the Epidemic of Typhoid Fever at Plymouth;* also *New York Medical Journal*, June 13, 1885.

Plymouth Water Company inspected the reservoirs, and, finding the two upper ones full, that same evening caused the water of the third reservoir to be let down directly to the lowest reservoir; that on the evening of this day pumping from the Susquehanna River ceased, and the town was again entirely supplied from the mountain-stream; that thus nearly three months' accumulation of infectious typhoid-fever dejecta was suddenly washed with the melting snow into the brook, and rapidly reached the lower reservoir, and was thence distributed through the pipes and hydrants of the Plymouth Water Company; that fifteen days after this date the epidemic began; that no other source of unusual pollution of the mountain-water was discovered."

Facts similar to the above might be greatly multiplied, but those I have selected from the epidemics of Geneva, Paris, and Plymouth will serve as types of the conveyance of typhoid infection by water, and amply illustrate the importance of prophylaxis in this direction. To quote again from the report of French and Shakespeare: "Had the infectious poison breeding in the evacuations of that one fever patient up near the top of Shawnee Mountain been destroyed by proper disinfectants or otherwise, that community of eight thousand people living in the valley would not have been shrouded with the pall of death or had its industries so blighted."

Conveyance of Typhoid Infection by Milk.—Next in activity to water as a carrier of the typhoid infection is milk. In most of the epidemics that have been traced to this source the milk had been diluted, or the cans containing it cleansed with water containing the germs of typhoid fever. In view, however, of the remarkable absorbent power of this fluid, as indicated by the readiness with which the taste and odor of contiguous substances are imparted to it, the question arises whether the typhoid virus may not gain access to milk without direct admixture in the ordinary sense of this word. The question may, in my opinion, be answered in the affirmative. In other words, milk may become affected not only by impure water, but by impure air. The fact is so notorious and so self-evident that milk may convey typhoid fever by being mingled with water containing its germs that I will not give any details of the numerous epidemics that have been caused in this manner. To enter into an argument to prove this mode of infection would be equivalent to arguing that milk is not destructive to the typhoid germs—a fact disputed by no one. I will merely refer to an epidemic in Carlisle, England,[1] in which an epidemic was traced to a dairy where a death from typhoid fever occurred on March 2, 1887, the water-supply being in no wise in fault. From this date until May 15th "twenty cases of typhoid fever were brought under observation, and through careful

[1] William Brown, *Sanitary Record*, July 15, 1887.

inquiry it was ascertained that, with one doubtful exception, all the affected individuals had derived their milk-supply from the Metcalfe street vendor, and had partaken of the milk in such a manner and at such times as were consistent with the theory of their having derived their infection from polluted milk. The water used at this dairy was that supplied by the city, and the supply-pipe was carefully examined by an expert and found to be quite tight and free from leakage." Cultivation-experiments were made with the water, which was found to be free from pathogenic organisms. The water thus being shown to be free from the typhoid poison, the mode of infection must have been different from that of the other principal milk-epidemics with which we are acquainted. "Presupposing the typhoid poison with which the milk became contaminated had its source in the sick inmates, several modes through which milk-infection may have taken place at this dairy present themselves as being highly probable. Thus, for example, during the sickness of the child the air of the overcrowded kitchen in which it was nursed, and where the milk was sieved, served out to customers, and practically stored, must have been charged with the specific poison of the excreta of the child; and the same kind of air-pollution must have taken place from the other case of sickness, owing to the stools being carried from the bed-room through the kitchen for disposal in the privy in the yard. Again, dry ashes in a fine state of division" (there was an ash-pit privy in the yard which received the evacuations of the patients), "when disturbed by air-currents or in any other way, carry through the air a considerable distance specifically infected house-dust or stools with which they may be mixed. The milk, being placed between the air of the yard and that of the kitchen, was thus exposed to typhoid infection on both sides. Further, the milk may have received its infection from the hands or clothes of the milk-vendor or of his wife, both of whom performed the double duty of nursing the patients and milking the cows. Lastly, the unused milk from the sick-room may have by some means found its way into that set apart for distribution."

These remarks are most suggestive, and indicate several vehicles of contagion other than drinking-water, to which latter attention has been, in my opinion, too exclusively directed.

In connection with the origin of the disease at the dairy itself it is an interesting fact that one of the cows "had been very ill about the time the first case of fever certified proved fatal at the dairy." Further investigation revealed the fact that sickness had been unusually prevalent among the cows of this dairy, nineteen having been prescribed for by a veterinary surgeon during the course of four years. As the dairyman kept only from four to five cows at a time, it is evident that the majority of the animals must have been ill at one time or another.

Mr. William Brown, medical officer of health of Carlisle, to whom we are indebted for the report of this epidemic, states that he has observed typhoid fever to be very fatal and to linger persistently "in the immediate vicinity of slaughter-houses, cow-sheds, and places where tripe and entrails are cleansed. Thus, for instance, during the last four and a half years there occurred in Carlisle, in the vicinity of two slaughter-houses placed in close proximity, 7 cases of typhoid fever. Near another slaughter-house the same number of cases. Near a shed where tripe and entrails were cleansed, 5 cases; at a similar place, 1 case; in a short street where four slaughter-houses exist, 11 cases; and near a large cow-shed, 9 cases of the disease. Of these 40 cases, 10 died, or 1 death in 4 cases, or about four times the ordinary rate of fatality from typhoid fever. Lastly comes the Metcalfe street cow-byre and slaughter-house, with its 5 cases of sickness, 3 of which died, and while this paper is being written arrives a notice of a death from typhoid fever in the Carlisle urban district of Greystone in a house placed close to a cow-byre of the ordinary urban type."

Brown quotes two writers whose observations were made in South Africa—Mr. Henry Lawrence and Dr. James F. Allen—the former of whom believes an intimate connection to exist between typhoid fever and the presence of the manure of horned cattle, while the latter "endeavors to establish a connection between the incidence of typhoid fever among the inhabitants of farms and a *specific enteritis* among young calves."

If these last-mentioned observations are correct, we would expect to find an unusual prevalence of typhoid fever among the employés of slaughter-houses, but thus far this has not been demonstrated. The only mention of butchers in Murchison's classic work is that they are "said by Dr. Tweedie to be particularly exempt from typhus."[1]

Conveyance of Typhoid Infection by Air.—Numerous well-authenticated instances of this mode of infection have been reported by Budd, Bouchard, Murchison, Liebermeister, Landouzy, and others.

Landouzy reports two cases of great interest.[2] The first was a man aged twenty-five who was the only person attacked in a family of ten, and whose diet, drink, and hygienic surroundings at first offered nothing to account for his infection. On closer investigation, however, it was ascertained that the ventilating pipe of a public water-closet in a court below opened about half a yard (50 centimetres) beneath the window of his bedroom. Another case from the same reporter is almost identical in every respect; in fact, the only difference was the sex of the patient. A girl of fifteen, the only one of a family of

[1] *Continued Fevers of Great Britain*, 3d ed., 1884.

[2] Communication of Brouardel in *Annales d'Hygiène publique et de Méd. légale*, tom. 18, 1887.

five who was attacked with typhoid fever, was found to occupy a bed-room beneath the window of which was the termination of the ventilating pipe of a privy in the yard below.

The following instance of infection by atmospheric emanations is related by Bouchard:[1] A man having contracted typhoid fever at Ulm returned to his native village, where there had been no case of the disease for many years. His evacuations were thrown upon a dung-heap ("fumier"), which was removed several weeks later by five men. Of these five, four were attacked with typhoid fever, and the fifth with intestinal catarrh and tumefaction of the spleen. The dejecta of this set of patients were thrown on another dung-heap, which was removed nine months later by two men, both of whom contracted typhoid fever.

A remarkable example of this mode of infection is reported by W. V. Keating.[2] Four ladies who had returned to their home in Philadelphia, which had been tightly closed for more than two months, were attacked with typhoid fever—the first a few days after their return, the other three about three weeks later. A foul odor was observed by all who entered the house, and Mr. Bryan, an expert who was called in to examine the drainage, declared that the family had been "actually living in a sewer." The following extract from his report reveals the state of affairs: "I made the examination, and found there was no main trap in the drain-pipe. There was a three-inch galvanized sheet-iron corrugated pipe leading from the French roof between the outer front wall and the studding, and exposed in the cellar, and connected with the terra-cotta drain near the cellar floor, every slip joint of which was pouring out its deadly contents of sewer gas, to be taken up by the large portable heater, which was supplied with cold air from the cellar, and distributed through the main building. I also found the waste-pipe from the second and third story wash-basins trapped in the cellar, and smelling at the connection with the terra-cotta drain-pipe near the floor. Here were two stories of waste-pipe (with no traps under the basins) to help to vitiate the air of their respective apartments. I also found a four-inch rain-conductor run down on the outside of the back building, near the main building, all joints of which poured out their quota of sewer gas to be carried into the house through the open windows in pleasant weather. You could not stand at any of the open windows in the rear portion of the house without being sensible of the presence of sewer gas in the surrounding atmosphere, caused by the exhalation of foul vapor from the rain-conductors of the surrounding properties. After digging up the front of the cellar to put in a main trap, my workmen found the terra-cotta pipe jointed with common lime mortar."

[1] *Transactions International Medical Congress*, Geneva, 1877.

[2] *Transactions College of Physicians of Philadelphia*, 1879.

Dr. Keating reported these cases as examples of the autochthonous or *de novo* origin of the disease, but I rather incline to agree with Dr. Cleeman, who, in discussing Keating's paper, called attention to the fact that the eruption was observed in the first patient on Sept. 27th —*i. e.* eleven days after her return to the house. As the eruption does not appear before the end of the first week or the beginning of the second, this would allow too short a space (three or four days) for the period of incubation. With reference to the three other cases, the nieces and granddaughter of the first patient, they were doubtless infected by the sewer gas, which was contaminated by the dejecta of the first patient or of other patients in the neighborhood.

It is useless to add to the number of these typical examples of infection through the atmosphere, but I may call attention to the fact that this mode of infection does not imply that the disease-germs are inhaled and enter the system through the pulmonary mucosa. It is much more probable that they adhere to the buccal or pharyngeal mucous membrane, are swallowed with the saliva or the food, and find their nidus in the ileum.

Infection by Soiled Linen.—I will give no details of the conveyance of infection by the soiled linen of patients or the hands of their attendants, because—1, owing to the natural repugnance to fæcal matter, and the cleanliness which it enforces in the most careless, this mode of infection is very rare; and, 2, it appears self-evident that if the air and water can convey infection from fæcal matter, the latter may do so itself, without, so to speak, employing any intermediary.

The Relation of the Depth of Water in Wells and Subsoil Water to Typhoid Fever.—Under this head the celebrated theory of Pettenkofer and Buhl may be appropriately considered. These observers noticed that in Munich the number of cases of typhoid fever bears a relation to the height of the water-springs, being highest when these are low. They do not believe in the propagation of typhoid fever by means of drinking-water, and explain the undoubted coincidence between the prevalence of this disease and a low level of the subsoil water by the theory that when the earth is uncovered by the recession of the water the air gains access to germs previously submerged and stimulates them to unusual activity. The poison, they say, enters the system through the medium of the atmospheric air.

Dr. Henry B. Baker,[1] secretary of the Michigan State Board of Health, has verified the statements of Pettenkofer and Buhl that the rise and fall of the typhoid-fever curve are in inverse ratio to the rise and fall of the subsoil water, with the notable exception that in winter, when the ground is deeply frozen, a low level of subsoil water does not

[1] *Twelfth Annual Report of the Secretary of State Board of Health of Michigan*, 1889.

correspond with an increased prevalence of typhoid. Dr. Baker's explanation of these coincidences is, to my mind, far more satisfactory than that of the German observers.

Suppose a privy and a well for drinking-water to be adjacent: "when the level of the water is the same in the well as in the privy, there would not be likely to be a mingling of the water from the privy with that in the well unless the distance between them was small. But whenever and wherever the water in the well is below the bottom of the privy, not far distant, there will be a strong tendency of the fluids cast into the privy to pass downward toward the water in the well, or, if not directly to the well, to the ground water not far distant, which will pass into the well to replace that which is drawn." In other words, when the subsoil water is low the drinking-water, where this is derived from wells, is especially liable to be contaminated with the fluid of cesspools; and the reason why the coincidence of low well-water with the prevalence of typhoid fever does not obtain in winter is because the fluid contents of privies are then frozen, and therefore incapable of permeating the soil.

I have entered into the foregoing details of etiology because of their practical bearing on prophylaxis, and further because there is a tendency when a single case or an epidemic of typhoid fever cannot be traced to an antecedent case through contaminated water, food, or air,—there is, I say, a tendency under such circumstances to assume that undue importance has been attached to these vehicles of infection, and that other equally powerful causes are in operation. The absolute demonstration of the conveyance of the typhoid poison by drinking-water, food, or air certainly does not exclude other modes of infection, but until these are discovered it is more rational to assume, when the known causes are not demonstrable, that the time and place of contamination have escaped observation than that nothing of the sort has occurred. On these grounds I would criticise the excellent little book of Marston,[1] who refers with evident approval to the view that "there is a variety of typhoid or enteric fever, apparently identical, so far as its clinical features and post-mortem lesions are concerned, with the typhoid fever of European pathologists, which should be ascribed to a combination of conditions rather than to any one specific cause; . . . . in short, to the various factors present in a new environment."

It is a well-attested fact that those who are undergoing the process of "acclimatization," so well described by Marston, are especially susceptible to the endemic diseases of their new environment; but this is an argument rather in favor of than against specific infection. The following remarks, made by me in opening a discussion on typhoid fever in the Philadelphia County Medical Society on November 24,

[1] *Notes on Typhoid Fever, Tropical Life, and its Sequelæ*, London, 1890.

1885, explain my views with reference to predisposition and change of climate as etiological factors of typhoid fever:

"There can be no doubt that certain individuals have a tendency to neuroses, congestions, and catarrhs in the infra-diaphragmatic portion of the trunk, just as others have similar tendencies in its supra-diaphragmatic portion. In such constitutions diarrhœa is produced by causes which, in the average individual, would be followed by no such effect, such as an unusually hearty meal, the partaking of food difficult of digestion, or of food that is easily digested but of a kind to which the individual is unaccustomed; a change in the customary drinking-water; or, finally and very commonly, atmospheric changes, thermometric and hygrometric. Now, this susceptibility can be only dependent upon an unusually sensitive condition of the abdominal sympathetic system. Abnormal fluxions of blood to the abdominal vessels are the result of irritants which in individuals of more stable equilibrium would not be pathological. Among such irritants is probably the poison, the germ, of typhoid fever. We are all acquainted with single cases of typhoid in families where all have been exposed to precisely similar influences. Why is it that in these sporadic forms of the disease the majority of those exposed to the infection escape? It is because the germ finds a favorable soil in one person and not in another; and this soil is probably a catarrhal mucous membrane, which very catarrh may have been produced by the irritation of the poison, so that in individuals of the type above described the germ of typhoid fever flourishes because it is able to produce its own culture medium—*i. e.* a catarrhal mucous membrane.

"Another cause favoring the development of the typhoid germ—and, I believe, through abdominal hyperæmia—is change of climate. Dr. Leffmann has confirmed my observation, made in a general way, of the large proportion of foreigners attacked with typhoid fever in a certain section of this city—that in which the Episcopal Hospital is situated. In a ten years' service at that institution I have yearly observed a large proportion, if not a preponderance, of Germans and Englishmen—mostly weavers—among the cases there treated."

From the foregoing remarks it is evident that the prophylactic treatment of typhoid fever may be divided into two heads: 1. Prophylaxis of the community, or municipal prophylaxis; 2. Individual prophylaxis. The former cannot be appropriately considered in this work. It belongs to the general subject of hygiene, and is not so much in the hands of physicians as in those of city officials. Science has enabled us literally to place our finger on this enemy of our race, and why should we hesitate to crush it? Certainly not on account of any possible expense, for, as Brouardel well remarks, nothing is so costly as an

epidemic.[1] The time has gone by when such visitations can be ascribed to the stars or the gods. The day of "stellar pathology," as it is called by Symes Thompson,[2] has passed, and our present knowledge has brought with it new responsibilities. For every case of typhoid fever some one is responsible, and for every epidemic the whole community.

Individual Prophylaxis.—Turning our attention solely to individual prophylaxis, we find that it includes the disinfection of food, especially water and milk, and of the discharges, both fæcal and urinary, of typhoid-fever patients. In times of epidemic the drinking-water should be boiled, and at all times in cities in which typhoid fever is endemic it should be filtered. The Bischof spongy-iron filter, the Chamberlain-Pasteur filter, and perhaps others, remove "much of the dissolved organic matter and practically all the suspended matter, including the microbes." The filtrate does not, however, remain sterile indefinitely. Sooner or later, the micro-organisms pass through with the water, probably by a process of growth, just as the bacilli of tubercle pass through the diaphragm from the pleural cavity and invade the peritoneal, or *vice versâ*. An occasional cleansing of the filter is therefore necessary, and in the case of the Chamberlain-Pasteur instrument this is very readily accomplished, for it is composed of tubes of unglazed biscuit-ware, which may be thoroughly sterilized by boiling.

With reference to suspected milk, the only safeguards are total abstinence or boiling.

The stools of typhoid patients should be immediately and thoroughly disinfected—a result which I have no hesitation in saying is scarcely ever accomplished. The crudest ideas prevail with reference to this vitally important matter, and the teachings of many accepted textbooks are misleading. For example, a recent work on hygiene recommends a 5 per cent. solution of carbolic acid as an efficient disinfectant of typhoid dejecta, and a little farther down on the same page stultifies this advice by the statement that the germicide action of this solution upon the discharges is not complete until twenty-four hours have elapsed. A typhoid stool should be thoroughly disinfected before it is thrown into the privy or water-closet, and therefore speedy action is one of the most important qualities of a disinfectant. On this ground carbolic acid should be consigned to oblivion, so far as its employment as a disinfectant in typhoid fever is concerned.

By far the best laboratory germicide is corrosive sublimate, 1 pro mille, but in the sick-room it is open to certain practical objections. The first of these is its poisonous nature. If kept in solution it should be colored, as recommended by Wilson, with potassium permanganate, but it should never be kept in solution. When needed a compressed tablet

[1] "Rien ne coûte cher comme une épidémie." [2] *Influenza*, London, 1890.

of the requisite strength, $7\frac{3}{10}$ grains, should be dissolved in a pint of hot water. Another practical objection to corrosive sublimate is that it coagulates albumin, so that in case of a typhoid stool containing blood-clot or sloughs from ulcers the exterior of these albuminous particles will be coagulated, while the typhoid bacilli will be carefully preserved within them. In such cases nothing short of trituration will thoroughly disinfect. Finally, corrosive sublimate is destructive to water-pipes and all kinds of plumbing-work.

The disinfecting power of lime has recently been the subject of careful study by E. Pfuhl[1] of Berlin, who has determined with precision the proportions by weight and volume in which it must be mingled with typhoid discharges in order to disinfect them in one, two, three hours, etc., the speed with which this is accomplished depending, of course, upon the quantity added. In the sick-room, however, it is out of the question to dispense a disinfectant by weight or measure as in a laboratory, and Pfuhl, who, being a practical physician, appreciates this fact, has ascertained that a typhoid stool is thoroughly disinfected when sufficient milk of lime (Kalkmilch) to produce a strong alkaline solution is mingled with it. Even this direction is too chemical, for it involves the use of test-paper, and therefore the nurse should be told to *deluge* the discharges and thoroughly mix them with the lime. The latter injunction is most important, especially when the discharges are not of fluid consistence. The advantage of lime as a disinfectant are its speedy and thorough action, absence of odor, cheapness, and entire safety, in all of which respects it contrasts most favorably with all other disinfectants. Unlike corrosive sublimate, lime is a penetrating substance; *i. e.* it does not, by hardening the surface of albuminous or other bodies, oppose a barrier to its own progress. In the present state of our knowledge of disinfectants I not only give lime the decided preference, but am almost inclined to say that none but lime should be used. With reference to its preparation, it is enough to direct the nurse to mix slaked lime in an earthen or wooden vessel with sufficient water to make a thick "whitewash."

Hydrochloric acid has been strongly recommended as a disinfectant of typhoid discharges, for which purpose they may be mixed with a solution containing 33 parts of crude hydrochloric acid and 67 parts of water. This substance is, however, open to objections similar to those which apply to corrosive sublimate. It is poisonous, destructive to plumbing-work, and, in addition, throws off irritating acid fumes.

It has been proposed to bury the fæces of typhoid patients, but this is a very questionable method of disposing of them, for Fränkel has demonstrated that the typhoid bacilli may multiply when placed in the earth three metres below the surface.

[1] *Zeitschrift für Hygiene*, Band 6, 1889.

Boiling water added to typhoid discharges does not surely disinfect them. Prolonged ebullition is necessary for this purpose—a method evidently out of the question.

The soiled as well as the unsoiled linen of typhoid patients should be boiled for several hours or destroyed by fire. For the hands of physicians and nurses the best disinfectant is thorough washing with soap and water, followed by rinsing with a solution of corrosive sublimate, 1 pro mille. A certain degree of ostentation in performing such ablutions is pardonable to the physician, if not actually enjoined upon him, for the sake of example to nurses and attendants. It is scarcely necessary to add that after using the clinical thermometer the instrument should be carefully cleansed and disinfected.

The measures of individual prophylaxis which I have enumerated are of the simplest description, but are none the less effective on that account. It is mathematically certain that if, in a given epidemic, the typhoid infection is conveyed by drinking-water, those who drink nothing but water sterilized by boiling or other means will escape. It is equally certain that if the chief source of infection, the fæcal matter of fever patients, be sterilized, the disease will be greatly diminished, if not extinguished. It is manifestly the duty of every individual to protect himself, to say nothing of others, from infection, and the instinct of self-preservation is so strong that it would seem unnecessary to inculcate it. The self-satisfaction of ignorance is, however, equally strong, especially when it relates to matters of hygiene, and therefore improvement in the prophylaxis of infectious disease can only be reached when hygiene is thoroughly taught in our schools and colleges and recognized as the most beneficent of the sciences.

Curative Treatment.

A case of typhoid fever is an instance of neglect or failure of prophylaxis. Unfortunately, at the present time such instances are so numerous that the physician, if not more concerned, is certainly more occupied in repairing the ravages of this disease than in preventing them. Its curative treatment, therefore, naturally assumes the first importance in the eyes of most practitioners, and may be divided into three heads—hygienic, dietetic, and medicinal.

Hygienic Treatment of Typhoid Fever.—The sick-room should be large, airy, well ventilated, and divested of unnecessary furniture. The windows should be behind the head of the bed or parallel with one of its sides, and of these two arrangements I prefer the latter, for there is something tantalizing in having the back turned to the light of day; while, on the other hand, it is most refreshing to many patients, especially in the country, to look out of doors, where the sight of green leaves trembling in the breeze is far more enlivening than that of their

dingy, flickering shadows on the wall. The fear of draughts is chimerical so far as the patient is concerned and so long as the fever continues, for the well-known dictum of Jürgensen is confirmed by universal experience: "Wer fiebert, erkältet sich nicht."

The light should be tempered, and in summer the sunlight excluded, but the tendency is to keep the sick-chamber too dark. Sleep at night is favored in the sick as in the well by preserving, as far as possible, the normal distinctions between night and day.

The temperature of the sick-room is never beyond control except in the tropics and during the excessive summer heat of so-called temperate zones. Under the latter circumstances the air may be cooled by exposing a large block of ice in a suitable receptacle, in accordance with Marston's suggestion. In cold weather heat and ventilation are best secured by means of an open fire. Whenever possible the thermometer should not be allowed to rise above 65° F.

Rest is an agent which may be looked upon either as hygienic or medicinal; but, whatever opinion be held of its nature, it is of the first importance in typhoid fever, and should be insisted upon as soon as the disease is suspected. If the patient is away from home when attacked, he had better, as a rule, remain away, for all ordinary inconveniences are better supported than the fatigue of a long railway journey. Liebermeister[1] and Sir William Jenner have called attention to the importance of rest in the beginning of typhoid, and the latter states that the effect of travel is "to make what would otherwise have proved a mild case severe, and to cause a bad case, which might after perhaps a struggle have ended favorably, to terminate in death." From my own experience I can recall cases illustrating the disastrous effects of physical exertion and railway travelling in the early stage of the disease.

Quiet should be preserved in the sick-chamber, and therefore no attempt to entertain the patient by reading or conversation should be permitted. I have never known a patient with typhoid fever to express the need of amusement or entertainment, or to complain of time hanging heavy on his hands. This is due to two causes: 1. The normal sensations with reference to the passage of time are blunted; 2. He is abundantly occupied with his own morbid fancies, which are not always of a disagreeable nature. I recently attended, through a well-marked attack of typhoid fever, a young woman, who never, during the course of the disease, manifested any signs of delirium, and who always returned rational answers to questions, and yet when I asked her during convalescence concerning certain objective features of her illness, she had no recollection of them whatever, while of the subjective scenes, and especially of an imaginary old woman who figured in most of them, her memory was excellent. It might be supposed by

[1] *Ziemssen's Cyclopædia*, vol. i., New York, 1874.

the inexperienced or unobservant that attempts should be made to divert the mind from its vagaries and restore it to normal paths. This, however, is a decided mistake, for the effort of inhibition required to fix the attention is attended, as in health, with fatigue; and it is on account of this mental fatigue or exhaustion that Nature has removed the brakes of inhibition. No attempt should be made to reapply them until the machine has been thoroughly repaired.

Dietetic Treatment of Typhoid Fever.—The most approved hygienic and medicinal treatment will be of no avail if the patient is allowed his own way with reference to diet. Remarkable stories are told by Stokes and others in illustration of the success which sometimes attends a compliance with the patient's whims in this respect, but none of them are applicable to typhoid fever. In this disease the characteristic lesions are seated in the gastro-intestinal tract, and are by no means necessarily limited to the ileum. Instances of typhoid ulceration in the gastric mucosa have been reported by Chauffard,[1] Chiari, Weiss,[2] and others, and there can be little doubt that they would be more frequently found if sought for. But, as I have elsewhere remarked, such a search is decidedly exceptional, since there is a general belief that all claims to represent typhoid fever have been long since pre-empted by the ileum.

Among the consequences of this localization of the morbid process are anorexia, dyspepsia, and diarrhœa, and the indications they furnish with reference to food are that it should be of the blandest, most digestible, and most nutritious character, and be administered at stated intervals with little or no regard to the patient's desires. It is very rare for a typhoid-fever patient to express a desire for food, but that is no proof that he does not need it. As Graves[3] remarks, it might as well be argued that the urine should be allowed to remain in the bladder because the patient has no desire to expel it, as that food should be withheld because he does not ask for it.

It is customary for writers on the dietetic management of typhoid fever to lay down the rule that no solid food should be administered in that disease, but a little reflection will show the crudity of such advice. It is not so much solid as indigestible food that should be eschewed, and it should never be forgotten that all foods except such as are predigested are solid in the first stage of digestion. Milk is justly regarded as the blandest, the most digestible, and the most nutritious food that can be administered to a fever patient, but from a dietetic point of view it is not a liquid food, for it no sooner enters the stomach than it is solidified by the milk-curdling ferment (the Labferment of the Germans)

[1] "Étude sur les déterminations gastriques de la fièvre typhoide," *Thèse de Paris*, 1882.

[2] *Wiener med. Presse*, Nos. 13 and 14, 1887.

[3] *Clinical Lectures*.

with which it comes in contact. There is no exception to the rule that digestion is a process of liquefaction. The habit of regarding milk as a liquid food has been the cause of much abuse in its administration. It has been apparently assumed by many practitioners that milk may be given *ad libitum* without bad effects, and that the proper quantity for the patient is determined solely by his ability to ingest it. Waiving the question of etymology, I need only refer to the case of a child abundantly supplied with some luscious article of food to prove that ingestion and digestion are very different things. As far as judgment is concerned, a patient with typhoid fever is *in statu pupillari*, and the amount of his food should be regulated by his ability to digest it. It is here that the judgment, the skill, and, above all, the experience of the physician come into play, for there are no fixed rules with reference to this important matter. The observant physician is, however, by no means without guidance, and his decision whether his patient's diet is correct as to quantity and quality will depend on his knowledge of the natural course of the disease and his diagnostic skill in determining whether a sudden rise of temperature, accompanied with restlessness, tympany, perhaps also with abdominal pain, is or is not due to indigestion. The most valuable assistance in solving this diagnostic problem may be derived from an inspection of the stools, in which the detection of shreds of undigested casein is proof positive that the patient is receiving too much milk.

In the dietetic management of typhoid fever the tendency at the present day is toward overfeeding, and especially with milk. A physician who undertakes the management of a case of typhoid fever in a region where good cow's milk cannot be procured is at a disadvantage, but he had better be deprived of this resource than use it injudiciously. I cannot better illustrate the importance of making the supply of milk subordinate to the patient's digestive capacity than by quoting from an address on the treatment of typhoid fever, delivered by Sir William Jenner before the Midland Medical Society at Birmingham on November 4, 1879:[1] "I have seen the patient restless, sleepless, or drowsy, his temperature raised several degrees above what it had previously been, vomit, eject a quantity of curd, and at once the restlessness cease, the temperature fall, the skin become moist, and the patient drop into a quiet sleep. All the threatening symptoms vanish with the ejection of the offending material. Or the undigested curds may accumulate in the bowel, inducing flatulent distension and pain in the abdomen, restlessness and increased febrile disturbance. Under these circumstances I have seen an enema of thin gruel bring away a large vesselful of offensive, sour, undigested curds. Or, again, the undigested curds may themselves (and this has not been an uncommon

[1] *Lancet*, vol. ii., 1879.

consequence of milk diet in my experience) irritate the bowels, and produce, keep up, or greatly increase diarrhœa. A distinguished chemist once remarked to me, 'Do not forget that a pint of milk contains as much solid animal matter as a full-sized mutton-chop;' and solid the casein of the milk must become before it can be digested; and yet I have known a patient drink two quarts and even more of milk in twenty-four hours—*i. e.* solid animal food equal to four mutton-chops. Can anything approaching to such an amount of solid animal food be digested? and if it could is such an amount of animal food good for a patient suffering from typhoid fever?"

In prescribing milk it must also be remembered that this substance is of variable composition, and that the patient's inability to digest it may be due to the fact that it is too rich in cream. According to Voit,[1] a healthy adult prisoner while idle requires 85 grammes of albumin, 30 grammes of fat, and 300 grammes of hydrocarbons *per diem*, while two litres (about $3\frac{1}{2}$ pints) of milk contain only from 68 to 70 grammes of albumin. The fat in this amount of milk will be twice as much as is necessary, and the hydrocarbons about one-third the necessary amount. In this statement it is presumed that the milk is an average specimen—*i. e.* containing not more than from 8 to 10 per cent. of cream. When it is remembered that some specimens of Alderney milk contain from 20 to 30 per cent. of cream, and that zealous attendants on the sick naturally suppose that when milk is ordered it must be of the richest quality, it becomes manifestly important for the physician, in prescribing this substance, to have an eye to its quality as well as its quantity. As regards quantity, not more than one quart of an average specimen (8 per cent. cream) of unskimmed milk should be given daily. If more than this amount is given, it should be skimmed. The deficit in albumin may be made up by giving meat-juice twice daily or some preparation of beef peptone. Home-made beef-tea is a very refreshing beverage, but contains little or no albumin, this substance being coagulated and retained in the meat during the process of cooking. There are several excellent manufactured preparations so rich in albumin that tea-spoonful doses furnish all of this substance that is required in typhoid fever. The articles to which I refer are so well known as to need no specific mention, and besides it is the duty of every intelligent practitioner to test such preparations for himself, both chemically and clinically.

The deficit of hydrocarbons above referred to as inherent in an exclusive milk diet cannot be made up, and clinical experience proves that the absence of these substances is not detrimental. I am not in favor of administering arrowroot, rice, oatmeal porridge, or, in fact, any form of solid or semisolid starchy food, to typhoid-fever patients.

[1] *Zeitschrift für Biologie*, 1872.

My objection to these substances does not arise from the fact that they are in any sense of the word "solid," but is based on the belief that they are indigestible. In typhoid fever the salivary secretion is very deficient, and the same is almost certainly true of the other secretion, the pancreatic, concerned in the digestion of hydrocarbons. Clinical experience also shows that the use of starchy food in typhoid fever gives rise to tympany and other signs of intestinal indigestion. A certain amount of soluble starch may safely be administered in the form of barley-water.

If milk is not digested, as proved by the presence of coagula of casein in the stools and other signs and symptoms of indigestion, it should not only be skimmed, but peptonized. Experience has proved the advantage of adding a small quantity of lime-water—half an ounce of lime-water to four ounces of milk—to each dose of milk. Any tendency to acidity is thereby counteracted, the casein is diluted, and its digestion facilitated. Goat's milk should never be selected for a typhoid-fever patient, as the coagula which it forms in the process of digestion are remarkably tough. If none other than goat's milk can be procured, it should invariably be peptonized.

The patient should be allowed an abundance of pure, cool water, and encouraged to drink it. The latter injunction is most important, for during the fastigium of typhoid fever the sense of thirst is as much obtunded as that of hunger.

The characters of the blood in typhoid fever are such as indicate a deficiency of water. In the first place, it is of a dark, blackish-red color, and is generally obtained by needle puncture of the finger with more than ordinary difficulty. In 1885, I counted the red blood-corpuscles in five cases of typhoid fever during the fastigium of the disease, the result being an average of 5,176,200 per cubic millimetre.[1] These figures are just what one obtains in perfectly healthy persons, and can only be explained by the theory of a deficit of water in the blood. This view is corroborated by the facts that in two of my cases I counted the corpuscles during the stage of convalescence, and in both found a marked diminution in their number—in one amounting to 804,000 per cubic millimetre; in the other to 1,306,000. This apparent falling off in the quality of the blood at a time when fever has ceased, appetite and digestion are good, and strength is rapidly returning, is evidently due to a restoration of water to the blood. The processes of hæmatopoiesis are the same after fever as after hæmorrhage: first, the volume of the blood is restored by the absorption of water; next and more slowly, the number of red corpuscles is raised to the normal; and, finally each corpuscle appropriates its proper amount of hæmoglobin. In one of my cases I noted that the fingers were shrivelled, "a condi-

[1] *The Polyclinic*, Philadelphia, September 15, 1885.

tion either to be explained by ischæmia from local vascular spasm or by a general deficiency of water in the blood. The condition was too long continued to warrant its being referred to vascular spasm, and the other positive facts in regard to the gross and microscopic characters of the blood point unmistakably to a state of *anhydræmia*."[1]

The late Dr. John Forsyth Meigs[2] was accustomed to insist with great emphasis on the importance of supplying water in abundance to typhoid-fever patients. His experience, which was unusually large, had led him to believe that death from this disease was often due to want of water, and he urged the importance of continuing to supply it after the patient had lost all sense of thirst. The following quotation is from a lecture delivered by him at the Pennsylvania Hospital in 1879: "When I stand by the bedside of a severe typhoid fever, and see the patient motionless, insensible, dead to all the usual senses of the living; when I look at his half-closed eyes, his gaping mouth, his dried and fissured tongue; when I brush the unheeded flies from his poor, unconscious face; and when I touch his hot and burning skin,—I ask myself into what lower estate the human body can fall. Not only has the patient lost all appetite for food, not only is he dead to all that surrounds him, but this hot and withered body, this dry and pasty mouth, filled with desiccated crusts and sordes, knows no longer even the sense of thirst. This has been the last sense of which he has been deprived. So long as he retained any consciousness at all he would ask for water or for ice. Now he feels not even this great want. It is in this crisis of his life that he is to be saved, if saved at all, only by the constant care of his physician, nurses, and relatives. And woe to the physician who can look on such a sight and not yearn to know all that his art has acquired through centuries of experience and study!"

With reference to the amount of water required by a fever patient, our standard of comparison is the quantity consumed by a healthy adult at rest. This has been found to be about eighty ounces. In typhoid fever, however, the organism, so far from being at rest, is in a condition of turbulent activity, and besides is undergoing abnormal losses of water through the increased action of skin and bowels. Eighty ounces can therefore only be regarded as the minimum supply.

[1] The surest method of conveying water to the tissues is by subcutaneous injection of "normal saline solution"—a solution of common salt of the strength of 50 grains to the pint. About three years ago I treated a number of cases of pneumonia at the Philadelphia Hospital in this manner, and with excellent results, both as regards palliation and cure. Hermann Sahli (*Volkmann's Sammlung klinischer Vorträge*, No. 11, 1890) has recently practised the same method with success in two cases of typhoid fever. By means of an apparatus designed by himself he was able slowly to inject a litre of the solution beneath the skin of the abdomen or elsewhere. One of the most rational indications of typhoid fever is certainly fulfilled by such injections.

[2] *On the Internal Use of Water for the Sick, and on Thirst*, Philadelphia, 1880.

Clinical experience, the highest court of appeal in all therapeutic questions, confirms the inferences derived from these physiological facts, it having been found by Meigs and others that one hundred and thirty ounces of water may be given daily to a typhoid-fever patient with none but beneficial results. It has been objected that such amounts of fluid, by their mere bulk, will interfere with the ingestion of other and more nutritious food. To this it may be replied that the question of nutriment is a relative one, depending upon the immediate wants of the system. To a person perishing from thirst nothing is so nutritious as water. The strongest argument in favor of the cold-bath treatment of typhoid fever is that it prevents certain tissue-degenerations, especially of the heart, which are generally ascribed to long-continued pyrexia. It is, however, at least questionable whether these cellular changes are not quite as much due to long-continued drought. We do not attribute the desiccation and decay of vegetables during the torrid heat of summer so much to the presence of heat as to the absence of water; and the facts with reference to our own tissues during the "heated term" of a fever are precisely analogous. The opinion that parenchymatous degeneration in typhoid fever is due to want of water is held also by Dr. Henry Hun[1] of Albany, who believes that it may be obviated "quite as well by giving plenty of water to the patient to drink as by cold baths." In a word, our bodies in health are more fluid than solid, and cannot perform their functions unless this fluidity is maintained: "*Corpora non agunt nisi fluida.*"

There is another food-substance, formerly prominent as an article of diet for the sick, which has fallen into unmerited disuse. I refer to gelatin. The history of this substance affords one of the innumerable instances of the tendency of the scientific mind to pass from one extreme to another. During the great French Revolution the feverish mental activity, which displayed itself most conspicuously in the field of politics, was manifested in every department of science. Among other subjects, the best and most economical method of supplying the French armies with food was studied by numerous physiologists in what now appears to us a very superficial manner. One of the hasty conclusions of their researches was that gelatin is the nutritious substance of meat, and that from one pound of bones could be extracted as much and as good soup as from six pounds of flesh. This opinion of the value of gelatin was formulated in the extravagant and inflammatory statement that one dozen bone buttons represented a certain amount of soup stolen from the poor. Notwithstanding this tender solicitude for their welfare, the poor never took kindly to the food recommended by the first gelatin commission of 1802 (24 Messidor, year X of the Republic), thus showing that the voice of Nature,

[1] *Albany Medical Annals*, 1885.

although not so loud as that of so-called authority, is much more convincing. By degrees doubts began to be entertained concerning the nutritive value of gelatin, which found their principal exponents in Donné, Gannal and Edwards, and Balzac. A second gelatin commission was appointed, which made its celebrated report through Magendie, in 1841, to the effect that gelatin is not only devoid of nutriment in itself, but impairs the nutritive value of other foods when mingled with them. Such a condemnation is, of course, absolute, and it is not surprising that the reputation of gelatin has never recovered from this verdict, which was pronounced by some of the greatest physiologists of the age. These are the extremes of opinion with reference to this substance—viz. extravagant laudation by the first gelatin commission, absolute condemnation by the second. The truth, as a matter of course, lies midway between them. Gelatin alone cannot support life; neither can albumin, which is a recognized type of nutritious substances. But whence, it may be asked, arose the error that gelatin mingled with foods of well-known nutritive value is injurious to the system? Simply from the fact that in those experiments of the second gelatin commission in which gelatin was mingled with other articles of food the former was added to the latter, as a rule, in inordinate quantity. Large amounts of gelatin give rise to diarrhœa, but the same effect follows the ingestion of too much fat or common salt. Without entering into details concerning the experiments of the second gelatin commission, it suffices to state that their fallacies have been exposed by Carl Voit, who in 1872 determined with scientific precision the real value of gelatin. The result of his researches may be summed up in the statement that gelatin is an albumin-sparing substance. In other words, the amount of albuminous food necessary to maintain our bodies in a state of nutritive equilibrium is lessened by the ingestion of a certain amount of gelatin. This albumin-sparing property of gelatin renders it a most appropriate food in febrile conditions in which there is excessive destruction of the albumin of the body, and it is best administered in the form of peptonized milk-jelly. This is very palatable, and is composed of peptonized milk, to which, while hot, a certain amount of gelatin is added. It is then sweetened, flavored with orange, lemon, wine, brandy, or rum, and eaten cold. In cases of typhoid fever in which diarrhœa is a prominent feature gelatin should be used sparingly or not at all.

To recapitulate: in the dietetic treatment of typhoid fever the main reliance should be upon milk, which may be given, skimmed, to the extent of two quarts per diem. This is a maximum amount. In addition, water should be freely administered, the patient being given as much as he will take. In one of Meigs's cases the average daily amount of free water consumed during a period of twenty-one days

was thirty-three ounces; in another, the average amount for eighteen days was fifty-three ounces. Besides milk and water, beef-juice or beef-peptone should be given at least twice daily, and once in the twenty-four hours a small cup of beef-tea, chicken-broth, or mutton-broth. An egg prepared in the following manner is often well relished and digested: a common *thick* kitchen cup is immersed in boiling water for one minute, then removed and the water poured out. A fresh egg is then placed in the cup, and rapidly stirred with a spoon or fork. The heat retained by the thick cup is sufficient to *cook* the egg enough to remove the raw taste which is so unpleasant to many people. I have found an egg prepared in this manner a valuable addition to the limited diet-list of fever patients. Finally, a claret-glass of peptonized milk-jelly may be given on alternate days.

On such a diet as I have outlined the patient will be abundantly nourished. The quantities of each article cannot be arbitrarily prescribed, but must be varied to suit the needs of individual cases. In order to furnish sufficient nourishment the intervals of feeding must necessarily be short, and it is a safe rule never to allow more than two hours to pass without the administration of either food or drink.

Medicinal Treatment.

The undoubted fact that the majority of cases of typhoid fever will recover without medication if the above-mentioned hygienic and dietetic measures are adopted, does not justify a purely expectant line of treatment, so far as drugs are concerned. This statement would still hold good if recovery were the invariable rule, for in that case our therapeutic efforts would be chiefly directed toward curtailing the course of the disease, mitigating its severity, and preventing complications. It may be said that this is more than we can certainly accomplish at the present time. Doubtless, this is true, but it is not nearly so much as we attempt, our first object being to save life. It is very difficult to convince one's self, to say nothing of others, that in a given case of typhoid fever life has been saved by the skilful use of drugs or other medicinal measures; but if, in a series of cases, we observe an immediate mitigation of the most threatening symptoms, followed by progressive improvement, we are certainly justified in believing that a certain number owe their recovery to the treatment pursued. This is precisely the experience of numerous competent observers, and it is underestimating the value of medicinal measures in typhoid fever to say that those who have had most experience in their use would be least willing to dispense with them. It must be admitted that there is no drug or method of treatment that will arrest the course of the disease. The claims of the so-called jugulant methods are all open to serious criticism. In the first place, such modes of treatment must be instituted on the first suspicion

of typhoid fever—*i. e.* at a time when it is impossible to say with certainty that the case is not merely one of gastro-intestinal catarrh, influenza, or other form of catarrhal fever; secondly, a certain number of mild cases—*typhus levissimus*—are observed in all epidemics, running their entire course in from twelve to fifteen days. In other words, the natural course of many cases of typhoid fever is an abortive one. If due allowance is made for errors in diagnosis and for cases essentially mild, there is nothing left to support the theory of a jugulant treatment of typhoid fever.

Although we know of no specific for this disease, the hope that one may yet be discovered is justified by the general results of modern bacteriological research, and especially by the destruction of the micro-organisms of one of the infectious diseases—the *Hæmatozoön malariæ*—by appropriate treatment. The effect of quinine upon this microbe, which has its seat in the red blood-corpuscles, shows that a specific will find its prey in the most recondite quarter of the organism. In the mean time, however, we must be content to mitigate as far as possible the effects of the typhoid poison. In other words, our treatment is almost purely symptomatic, and has for chief objects the control of pyrexia, diarrhœa, and other abdominal disorders, and the prevention of complications. The latter indication may be regarded as prophylactic rather than symptomatic, but the surest mode of forestalling complications is to be on the alert for the symptoms by which they are almost always heralded.

Antipyretic Treatment.—Although typhoid fever may run its course, sometimes a fatal one, with little or no elevation of temperature, the control of pyrexia is undoubtedly a prominent indication in the great majority of cases. From the earliest times this has been met by the use of baths and effusions either warm or cold. For example, Hippocrates is responsible for the statement that a fever which does not proceed from the bile is cured by abundant effusions of warm water upon the head.[1] Although bearing but indirectly upon our subject, it is an interesting fact that Rhazes advises cold baths in measles: "But if you find the patient after this medicine suffers uneasiness and anxiety, and perhaps fainting, then let him sip cold water, and sit in it for a short time; and cover him up, until his inquietude is assuaged and the measles come out to the surface of the body."[2]

To James Currie[3] undoubtedly belongs the credit not only of having

[1] Ἢν πυρετὸς μὴ ἀπὸ χολῆς ᾖ, ὕδατος πολλοῦ καὶ θερμοῦ κατακεομένου κατὰ τῆς κεφαλῆς λύσις τοῦ πυρετοῦ γίνεται.—*Aphorisms*, section vii., No. 42.

[2] Greenhill's translation, p. 92, Sydenham Soc.'s edition.

[3] *Medical Reports of the Effects of Water, Cold and Warm, as a Remedy for Fever and other Diseases*, Liverpool, 1798.

first systematically employed cold ablutions in the treatment of fever, but also of having obtained the indications for their use by the thermometer. It is a most interesting fact that this practitioner, who was nearly a century in advance of his time, took the temperature precisely as it is now taken, and even invented a self-registering thermometer for the purpose.

"In taking the heat of the patient," says Currie, "I have generally used a small mercurial thermometer of great sensibility, with a movable scale, made for me by Mr. Ramsden after a form invented by the late Mr. Hunter, and used by him in his experiments on the heat of animals; and I have introduced the bulb under the tongue with the lips closed, or under the axilla, indifferently; having found by repeated experiments that the heat in these two places corresponds exactly, and gives a just indication of the heat of the surface of the body where sheltered by the necessary teguments and secluded from the contact of the external air. Finding, however, considerable risk in using the straight-tubed thermometer in contagious diseases, I got some instruments of this kind made with a small bulb curved at the end. The bulb being introduced under the tongue or the axilla, the observer can stand behind the patient and mark the rise of the mercury without coming into the immediate sphere of his respiration. Though no injury was in any case incurred from the use of this thermometer, yet a further improvement has suggested itself. By introducing a small piece of iron into the tube, after the manner of Mr. Six, a permanent indication of the greatest heat is obtained, and the approach of the observer toward the patient during the experiment becomes unnecessary."

While Currie's cases were mostly typhus, there can be little doubt that cases of typhoid—a disease at that time confounded with typhus—were also treated by him with cold effusions. He was induced to employ this method by the narrative of Dr. Wright of Jamaica, who was attacked with fever, caught from a sailor, on his homeward voyage to England. Wright noticed that when on deck, exposed to the cold air, he felt better in every respect; and this circumstance, coupled with the failure of other means of relief, induced him to practise on himself what he had long wished to try on others in fevers similar to his own. He gives the following account of his experiment: "*Sept. 9th.* Having given the necessary directions, about three o'clock in the afternoon I stripped off all my cloaths, and threw a sea-cloak loosely about me till I got upon the deck, when the cloak also was laid aside. Three bucketsful of salt water were then thrown at once on me. The shock was great, but I felt immediate relief. The headache and other pains instantly abated, and a fine glow and diaphoresis succeeded. Toward evening, however, the febrile symptoms threatened a return, and I had again recourse to the same method as before, with the same good effect.

I now took food with an appetite, and for the first time had a sound night's rest.

"*Sept. 10th.* No fever, but a little uneasiness in the hams and thighs; used the cold bath twice.

"*Sept. 11th.* Every symptom vanished, but to prevent a relapse I used the cold bath twice."

Another passenger on the same ship was also attacked with fever, and was treated successfully with cold affusions. Wright's voyage in which he practised this treatment was made in the year 1777. The cases were probably typhus.

Currie mentions certain precautions which should be observed by the physician employing the cold-bath treatment of fever: 1. It should not be used when "any considerable sense of chilliness is present, even though the thermometer, applied to the trunk of the body, should indicate a degree of heat greater than usual." 2. It should be used with great care, if at all, when the surface is bathed in perspiration.

He points out that perspiration is often prolonged by artificial means, such as too much bed-covering, the body being thereby prevented from cooling. Under such circumstances the heat will sink rapidly on mere exposure to the external air—a measure, by the way, too little employed. It is meddlesome therapeutics to plunge into a cold bath a patient whom Nature is endeavoring to cool by profuse perspiration.

The work of Currie bears the stamp of exact observation and careful experiment, and, although his fame has been overshadowed by more recent hydropathists, this does not imply that their merits are greater, for the power of one object to eclipse another does not depend so much upon its size as its proximity to the eye.

With reference to Currie the late Dr. Seguin[1] remarks: "Thermometry pervades the whole of Currie's practice; nevertheless, it influenced very little the medical profession. So that for many years his *Medical Reports* stood alone, ... a melancholy monument of what a single man can conceive and the many cannot comprehend."

In 1849, Wanner[2] advocated the treatment of all phlegmasiæ, whether general or local, internal or external, by the application of cold. He employed cold poultices in surgical affections, and in his medical febrile cases administered ice by the mouth and a cold enema every six hours, conjoined with sponging the surface with ice-water. In 1866 the same author communicated his mode of treatment to the Academy of Medicine in a memoir which was examined by a commission composed of Louis, Grisolle, and Briquet. In their report it is stated that one of the commission had observed the effects of this treatment for several years in hospital practice, and had always found it efficacious.

[1] *Medical Thermometry and Human Temperature*, 1876.

[2] *Compt. Rendus de l'Académie des Sciences*, tom. xxix. p. 591.

Under its use agitation, delirium, and cephalalgia invariably diminished or disappeared. Besides sponging his patients at short intervals with cold water, Wanner administered an emetic and a saline purgative at the commencement of the illness, and allowed nothing but bouillon and wine for nourishment.

Excellent results were obtained by Le Roy[1] (de Béthune) by the conjoined employment of bleeding and the external application of cold. Starting out with the proposition that the two most important indications in the treatment of typhoid fever are to combat congestions of internal organs, especially the lungs, spleen, and brain, and to reduce the temperature, Le Roy declares that these are fully met by bleeding—a therapeutic agent which he believes to be as important in this disease as quinine in the malarial fevers. The amount removed from an adult by Le Roy averaged from 850 to 1500 grammes, while in children under the age of six he had recourse to leeches. It is only during the first week of the disease that he recommends bleeding. After this period he believes it to be contraindicated, but not, as may be supposed, lest the strength of the patient be too much reduced by the loss of blood, but because during the second week there have formed in the intestine ulcerations which, says Le Roy, are so many open doors for the introduction of putrid material into the blood; and, he continues, every one knows that bleeding is favorable to absorption. This intelligent observer does not claim to have aborted typhoid fever by bleeding, but merely to have given the course of the disease a favorable direction. After the bleeding a marked remission of the principal symptoms is observed, but this is of short duration, and the disease soon reverts to its former course unless the favorable effect of the depletion is maintained by the application of cold. The refrigerant treatment is thus applied by Le Roy: A folded cloth or large napkin is immersed in water as cold as possible, applied to the abdomen, and covered with a dry cloth to prevent wetting of the patient's arms and bed-clothes. The dressing is at first renewed as soon as it becomes warm; later, in accordance with the general temperature and other symptoms, although it does not appear that Le Roy was guided in his treatment by the thermometer. Internally cold water is given freely by the mouth, and occasionally by enema. No medicine is given, unless a decoction of dog's grass ("chiendent") be regarded as a drug. Under this treatment Le Roy claims that the skin gradually cools; the pulse loses in frequency and gains in regularity; headache, stupor, and delirium disappear in a few days; thirst is appeased; the tongue becomes clean and moist; abdominal pain and tenderness, meteorism and diarrhœa, diminish; natural sleep returns; in a word, there soon remain so few traces of the disease that from the eighth to the fifteenth day the patient

[1] *L'Union médicale*, 1852.

is apt to regard himself as cured, and the inexperienced physician is likely to agree with him.

I have referred somewhat *in extenso* to Le Roy's treatment for several reasons: In the first place, his work bears the stamp of accuracy and is based on a large experience; secondly, he was one of the first, after Currie, to carry out in a systematic manner the refrigerant treatment of typhoid fever, his first use of it having been made in 1847; and finally, his results have scarcely been surpassed. Unfortunately, he includes in his tables cases of typhus fever, which were treated in the same manner as the typhoid cases. It is therefore impossible to estimate his results with accuracy. When, however, it is recalled (1) that the average mortality of typhus fever in adults is at least as great as that of typhoid; (2) that no children were treated; (3) that the number of typhus cases bore a small proportion to that of the typhoid,—it must be conceded that his results, considering that his patients were all hospital cases, and therefore in many instances far advanced before treatment was instituted; it must, I say, be conceded that his results are unusually good, even from the therapeutic standpoint of to-day.

There were, in short, only 6 deaths out of the 141 cases treated by Le Roy in 1847–51; *i. e.* 1 death in $23\frac{1}{2}$ cases. Of the 141 cases, 23 were typhus, so that, proceeding on the improbable assumption that all the deaths occurred in the typhoid cases, there would be 118 cases with 6 deaths, or 1 in $19\frac{2}{3}$. At the present day no physician would admit that the bleeding in the early stage of the disease was in any way conducive to this favorable result. On the contrary, the verdict would be unanimous that the success achieved was due to the refrigerant treatment and occurred in spite of the bleeding.

The Brand Method.—The cold-bath treatment of typhoid fever is indelibly associated with the name of Brand,[1] who was the first to reduce it to what may fairly be called a mathematical system. In the evolution of his ideas on this subject three distinct periods can be traced. In his first publication, in 1861, he formulated his results in the statement that if typhoid fever be treated with cold baths from the commencement, there is, as a rule, nothing to be feared, and even in the gravest cases a cure may often be obtained. In 1863 he becomes more positive: his method of treatment has been adopted and endorsed by others, whose results have equalled his own. He now writes that every case of typhoid fever treated regularly by his method runs a mild course, and fatal cases are scarcely ever encountered. In 1868 the method is systematized in every respect, and has been widely employed throughout Germany. Brand now declares that the methodical treatment of typhoid fever with cold baths from the onset of the disease renders a cure certain; and Glénard of Lyons, who intro-

[1] *Die Hydrotherapie des Typhus*, Tübingen, 1877.

duced Brand's method into the hospitals of that city in 1873, is equally positive as to its efficacy. So far as I am aware, such claims have never been advanced in favor of any other method of treatment, either of typhoid fever or any other zymotic disease. It therefore deserved the fullest investigation. Before, however, calling attention to certain criticisms of the Brand method which have been made with apparent justice, as well as pointing to certain contraindications against its employment, I will state briefly its technique:

The temperature of the bath should be from 18° to 20° C. (64.4° to 68° F.); it should last fifteen minutes, and be repeated every three hours so long as the rectal temperature exceeds 38.5° C. (101.3° F.). In hospitals it is most convenient to place the patients in a ward communicating directly with a bath-room, to which they may be conveyed in a wheeled chair. When this is impracticable, a portable bath on wheels may be brought to the bedside, surrounded with a screen, and the patient placed in it. The entire trunk and all the extremities should be immersed, leaving only the head uncovered. As soon as the patient is placed in the bath, water still colder than that which it contains should be poured over his head, usually for the space of a minute. This affusion seems to lessen the shock of the cold plunge, and especially the respiratory embarrassment which at first accompanies it. It is scarcely necessary to say that the physician himself or a trained and intelligent nurse should personally supervise every detail of the bath, and that the patient during his immersion should be watched with the greatest care. In the course of a few minutes he will present the principal signs of a chill, such as rigor, chattering of the teeth, and paleness or blueness of the lips. These may be prevented or mitigated by friction of the upper extremities and thorax, for which purpose a "loofa" may be used. If the signs of chill are well marked, as they generally are at the expiration of ten minutes, a few tea-spoonfuls of a strong wine, such as port or sherry or a good claret or burgundy, or brandy and water, should be administered and a second cold affusion applied to the head. The patient is now removed from the bath, enveloped in a sheet which is covered with a blanket, and replaced in bed, without any attempt to dry the skin. He may then be given a little hot soup or a few tea-spoonfuls of undiluted wine. The bed-covering should be light, in order to protract the effect of the bath as long as possible.

It cannot be denied that this mode of treatment is repugnant to many patients, but the relief it gives them is often so great that after the first few baths instead of objecting to its continuance they will demand it. In general terms, the disagreeable sensations produced by the bath are in inverse ratio to the stage of the disease and the degree of pyrexia; or, in other words, the earlier the stage of the

disease and the higher the temperature the better is the bath supported. (See article on Hydrotherapy, Vol. I.)

The chief objections to Brand's method are—first, that to obtain the best results from it it must be instituted before the fifth day of the disease; *i. e.* at a time when it is often impossible to establish the diagnosis with certainty; and, secondly, that it is applied to all cases indiscriminately. It seems impossible to rid the mind of the idea that the cold bath in fever is an heroic proceeding, and therefore to be reserved for the severest cases. The latter objection is met by the statement, undoubtedly correct, that the mode of invasion of typhoid fever affords no certain prognostic data, cases apparently of mildest type at the beginning often terminating fatally by intestinal perforation or other complication, while others whose onset is attended with the gravest nervous symptoms may end in recovery. In fact, it is not until about the twelfth day that the febrile symptoms, either by persisting, augmenting, or diminishing, enable one to hazard a prognosis as to the result. With reference to the first objection, it is of little importance practically that an occasional diagnostic error is made and cases of ephemeral or malarial fever are treated with superfluous heroism, for it is well established that in fever generally the cold bath is not only innocuous, but beneficial.

Outside of Germany the cold-bath treatment has not been generally adopted. In France it was first employed in Lyons in 1873, where it was introduced by Glénard, who was taken prisoner during the war of 1870 and sent to Stettin, where, for five months, he had the opportunity of observing the method as practised by Brand himself.[1] From July, 1873, to January, 1874, 53 cases were treated in two hospitals at Lyons, the Croix-Rousse and the Hôtel-Dieu, with only 1 death. This result was the more striking as the general mortality from typhoid fever in Lyons during 1873 had been 26 per cent. In 1874 there was a severe epidemic of typhoid fever at Lyons, and the authorities of the Hôtel-Dieu gave their medical staff every facility for carrying out the cold-bath treatment; so that for a time the daily average number of baths in that institution amounted to 600. Still, the number of cases was too large to permit of all being treated by the Brand method, and only the severest were selected for this purpose. Out of 518 cases admitted, 228 were treated with cold baths—a number certainly large enough to afford a satisfactory test of this or any other mode of treatment. Of these 228 cases, 25 died, a mortality of 10.9 per cent.: 290 cases were treated at the same time and place by the medicinal methods at that time in vogue ("*par les méthodes habituelles*"). Of these, 29 died, a mortality of 10 per cent. Notwithstanding the figures, this result was decidedly favorable to the cold-

[1] E. Chapuis, *Thèse de Paris*, 1883.

water treatment, which, as already stated, was only applied to the gravest cases.

The subject was next investigated by the Société des Sciences Médicales, which appointed a commission for the purpose. Circulars containing questions as to mode of treatment, etc. were sent to every physician in the city, but were answered by only thirty-nine. The reporter of the commission, M. Mollière,[1] was, however, able to collect 750 cases. Of these, 300 were treated by the Brand method, with 25 deaths—about 9 per cent. The other methods of treatment gave a mortality of 5 per cent.

The report also stated that under the cold-water treatment complications had been less numerous and less severe than under treatment by the ordinary methods. The contradictions involved in this statement are so glaring as to deprive these statistics of credibility, for it is equivalent to saying: the fewer and the milder the complications the greater the mortality. The report was not accepted by the society, and Mollière himself continued, in spite of it, to employ the cold-bath treatment in his own practice. The explanation of the inconsistencies in Mollière's report is found in the small number of those who replied to the circular above referred to. It was based on very incomplete data, as is shown by the fact that while 262 deaths from typhoid fever occurred in Lyons during the epidemic, the commission had official knowledge, through the circular, of but 64.

This investigation, if such it can be called, although manifestly imperfect, taken in connection with the natural prejudice against the cold-bath treatment, had the effect not only of preventing its general employment, but of discouraging those who had regarded it favorably. About the same time also opinions adverse to the claims of Brand were published by Péter[2] and Raynaud[3] of Paris, the former of whom expressed himself to the effect that in therapeutics generally, and especially in the treatment of typhoid fever, the best system is to have no system. Raynaud also reported two fatal cases treated by Brand's method, the treatment having been instituted before the seventh day, and declared that nothing could be falser than Brand's statement that all cases of typhoid fever treated with cold baths during the first week would infallibly recover. These and other obstacles to the general use of the Brand method in France have thus far proved insuperable.

In England, owing to the stand taken by the leaders of medical thought, it has fared no better. In 1879, in the course of his celebrated address on the treatment of typhoid fever, Sir William Jenner expresses himself in the following carefully guarded manner: "The treatment of typhoid fever by cold baths when the temperature reaches 104°, or

[1] *Lyon Médical*, vol. xxii. pp. 219, 262. [2] *L'Union médicale*, 1877.
[3] *Bulletin général de Thérapeutique*, tom. xci., p. 487.

even less, is very generally adopted in Germany; but neither my own limited experience nor the evidence adduced by others in its favor has carried conviction to my mind of its advantage. At the same time, I entertain no doubt that the direct cooling of the body is in some cases essential to the preservation of the life of the patient—gives him, so to say, his only chance of recovery; while in others it alleviates the severity of a symptom which increases the danger of the patient."

In the following year Cayley[1] expresses himself more decidedly in its favor. He believes it impossible to doubt that this mode of treatment considerably diminishes the rate of mortality, which, formerly decidedly lower than that in the German hospitals, is now (1879) more than double.

In 1887, Collie,[2] writing of the Brand method, says that the existing data do not sustain the claims that have been made for it. At the time of the appearance of Collie's book Brand's latest statistics were not published, but they are now the chief "existing data" to which all advocates of his method appeal. They are given in the course of a series of articles in the *Deutsche medicinische Wochenschrift*, 1887. Brand, having at that time an experience of thirty years in the treatment of typhoid fever with cold baths, positively declares that every case treated according to his directions, the treatment beginning before the fifth day, will recover. In support of this remarkable statement he offers the following figures:

Jürgensen (Tübingen)	217 cases,	1 death.
Vogl (Munich)	221 "	6 deaths.
Military hospital (Stralsund), 1877–82	257 "	1 death.
Military hospital (Stettin), 1877–82	186 "	3 deaths.
Brand (private practice)	342 "	1 death.
	1223 cases	12 = 1 per cent.

Not one of these twelve deaths occurred in a case that came under treatment before the fifth day.

In this country the Brand method has not been widely employed, although the opposition to it, if such it can be called, has been almost entirely passive. The obstacles in its way are the same as were encountered in England, and are traceable to the fact that the leading practitioners of the large cities have been discouraged by the results of an imperfect application of the method or have had no experience of it whatever. Quite recently a considerable number of cases have been treated in this manner at the German Hospital of Philadelphia by J. C. Wilson[3] and others, with most encouraging results. Wilson treated 40 consecutive cases with cold baths, all recovering; at the same time

[1] *Croonian Lectures on Typhoid Fever*, London, 1887.

[2] *Fevers*, Philadelphia, 1887.

[3] *Medical News*, December 6, 1890.

he treated 10 cases "either upon the expectant method or by means of carbolized iodine." . . . . "Of the 10 cases treated according to the old method, 1 died, the patient being a man aged thirty-three years, admitted at the end of the second week of the attack, and already suffering from an intestinal hæmorrhage. Death occurred on the third day after his entrance to the ward." This last case should scarcely enter into the comparison of the two modes of treatment, for it is doubtful whether any one but Brand himself would have had the temerity to treat it with cold baths. Wilson's term of service at the German Hospital, during which the cold-bath treatment was pursued, terminated on July 15, 1890. His report was published on November 4th, and in the interim the same method of treatment was pursued by his colleagues, Drs. Trau and Wolff, 24 additional cases having been treated without a death. "The statistics of the German Hospital, then, as regards enteric fever, are from February 1, 1890, to November 4, 1890, 64 cases treated by the cold baths without a death."

Dr. D. J. M. Miller has recently introduced the Brand method into the Episcopal Hospital of Philadelphia. In reply to my inquiry as to his results and impressions, he tells me that about 20 cases were treated strictly with cold baths every three hours while the temperature registered 101½° in the mouth or 102° in the axilla. There were 3 deaths—2 from intestinal perforation, 1 from pneumonia. In one of the cases the perforation "seemed to be caused by the bath—*i. e.* it occurred while the patient was in the tub; and in the other the relation was not so close." The 3 fatal cases were admitted at a late period of the disease—1 on the fifteenth day; another on the sixteenth, and the third on the seventeenth. Every case treated before the fifth day recovered, "and not only recovered, but seemed to lose the ordinary signs of typhoid fever"—*i. e.* there was no diarrhœa, no tympany, no dryness of tongue, and very little headache or other nervous symptoms. Dr. Miller, whose cases will be reported in full, declares himself to be most favorably impressed with the cold-bath treatment. Although his cases are not numerous, they are important as representing the kind of patients which the hospital physician is called upon to treat. In my experience it is rare for a patient with typhoid fever to be admitted to a hospital during the first week of the disease, so that neither the Brand *nor any other* method has fair play in these institutions. Miller's cases, added to those treated at the German Hospital, brings the number up to 84, which, with 3 deaths, gives a mortality of about 3.6 per cent.[1]

[1] I have made no attempt to collect all the cases treated by cold baths in this country. Among the first, if not the first, to introduce this mode of treatment into the United States was Dr. Robert T. Edes, formerly of Boston, now of Washington. Edes' cases were treated at the Boston City Hospital from 1872–74, and are reported in the

Unprejudiced consideration of the Brand method causes two facts to stand out prominently: 1. The statistics of cases in which it has been rigorously applied are far more favorable than those of any other mode of treatment. A physician may treat 40, 50, or even 100 cases, without a death by careful hygienic and dietetic measures, aided by drugs of undoubted efficacy, but who, except Brand and his disciples, has treated 1200 cases with a mortality of 1 per cent.? 2. It cannot be thoroughly carried out in private practice until it has been generally tested in hospitals, with results surpassing those of any other method of treatment; but to ensure the acceptance of these results by the profession the cases on which they are based must be counted by the thousand. Statistics based on fifty, or even a hundred, cases are only of value to the physician who has treated them. To him the experience acquired by their study is invaluable, chiefly because no two of them were alike; but for that very reason their statistical importance is slight. In large statistics the various influences which in a small epidemic might turn the scale in favor of or against a special mode of treatment are cancelled by the presence of their opposites, so as to leave the balance to be decided by therapeutic measures alone.

Antipyretic Drugs.—The cold-bath treatment, when successfully carried out, is believed by Brand to dispense entirely with drugs, although some of his disciples continue to employ them as adjuvant thereto. The objection to the use of antipyretic drugs is that they do not lower the temperature without at the same time producing a depressing effect upon the system. In cases treated properly from the beginning they are rarely necessary, and should always be regarded as secondary agents to be reserved for emergencies of hyperpyrexia in which the cold bath cannot be promptly procured or fails of its usual effect. The chief of these drugs are quinine, salicylic acid and some of its salts, and the coal-tar antipyretics, especially antipyrine and acetanilid (antifebrin). The least perturbating and the least efficacious of these drugs is quinine, which, to produce an antipyretic effect, must be given in doses of one scruple to half a drachm or even more. We are largely indebted to Liebermeister[1] for our knowledge of the antipyretic action of quinine and the proper mode of prescribing it in typhoid fever. This well-known clinician directs that the entire amount be given in the evening, in fractional doses of 50 centigrammes (7½ grains) each, and at intervals of ten minutes, so that in the course of half an hour, or at the most of one hour, the desired amount be admin-

Medical and Surgical Reports of that institution for 1877. The plan adopted by him was that of Ziemssen, the patient being placed in water of 100° F., which was gradually cooled down to about 70°. His conclusions are that "of 32 patients in three different years, *where a clear diagnosis of typhoid fever in the first week is admissible*, only 1 died."

[1] *Ziemssen's Cyclopædia*, vol. i.

istered. It is given in what is practically one dose, because the elimination of quinine from the system is so rapid that thirty or forty grains distributed in small doses throughout the twenty-four hours would have little or no antipyretic effect; and the evening is selected as the time for its administration, because the maximum effect of a massive dose of quinine is not obtained until after the lapse of from six to twelve hours. In other words, when given in the dose and at the time specified by Liebermeister the antipyretic action of quinine coincides with the natural tendency of the disease toward a morning remission. So impressed was Liebermeister with the advantages of this mode of treatment that, writing nearly twenty years ago, he declared that, notwithstanding his high estimate of the cold-water treatment, and his positive conviction that it would be wrong to treat a severe case of typhoid fever without the systematic abstraction of heat, he would, if forced to the unpleasant alternative of choosing between cold water and quinine, in the majority of cases select the latter. Whether or not he has since modified this statement I have been unable to ascertain.

With reference to the preparations of quinine, either the sulphate, the hydrochlorate, or the hydrobromate may be prescribed; and as to its mode of administration, it may be given in solution, suspension, capsule, or cachet. I prefer to give it in suspension in the case of children, and in capsule to adults. A gelatin capsule should, however, never be given to a patient who is taking whiskey or other alcoholic stimulant, for the effect of the alcohol in the stomach is to harden the capsule and render it more or less insoluble. If the quinine causes vomiting, as it not uncommonly does, it may be given with equal efficacy by the rectum, either in suppository or in suspension with a few drops of tincture of opium. Owing to the discovery of more powerful agents the antipyretic use of quinine has fallen of late years into abeyance. This neglect is, however, undeserved, and is not unlikely to be atoned for by its cautious resumption.

Salicylic acid and its salts have not commended themselves to the profession. They are believed by many practical physicians to exert a depressing effect upon a heart already laboring under the combined effects of a specific bacterial poison and a high temperature.

The same is true of antipyrine and acetanilid, although there are cases in which I have used them with decided benefit. He who is aware of the possible danger attending the use of these powerful drugs is least likely to incur it. The rapid fall of temperature produced by these remarkable agents has been, in some instances, attended with an alarming state of collapse. The best safeguard against such accidents is moderate dosage. Fifteen grains of antipyrine given in the course of a half hour, in doses of five grains each, are, as a rule, sufficient to produce a decided effect, and I possess a temperature-chart which shows

that on several occasions five grains of acetanilid caused a defervescence of from 4.5° to 5° F. On another chart a fall of nearly 6° (from 103.6° to 98°) was effected by the same dose. I have frequently seen a decided impression upon the temperature produced by doses of 2.5 grains of this substance.

Digitalis is another drug which deserves mention under this head, if for no other reason than because it was highly esteemed as an antipyretic by the late Dr. Murchison. In medicinal doses it stimulates the vagus and lessens the rapidity of the heart's action. At the same time it induces contraction of the small arteries, and so raises the arterial and diminishes the venous pressure. This heightening of the arterial pressure is said to be more marked in the internal vessels, especially those of the mesenteric system, than elsewhere; "hence the blood is diverted from the heat-producing to the heat-dissipating organs, and consequently the temperature falls." It is a remedy which should be used with great caution, especially when the myocardium is degenerated, as it is so apt to be in late stages of typhoid fever. To produce an antipyretic effect it must be administered in full doses, and therefore, in spite of careful supervision, the undefined boundary-line between its medicinal and its toxic actions may be suddenly and unexpectedly passed.

Intestinal Antisepsis.—Next to antipyresis the most prominent indication in typhoid fever is intestinal antisepsis; in fact, it is a question whether this is not, strictly speaking, the primary indication, for the fever is secondary to processes which have their origin in the gastro-intestinal tract. The discovery that the intestine is a species of laboratory in which are formed poisons capable of aggravating or, as some hold, of originating disease, is the result of the researches of several European observers. In 1870, Selmi discovered, in the body of a man who was supposed to have been poisoned, a substance chemically identical with certain vegetable alkaloids. This discovery might have led to a miscarriage of justice had he not found the same substance in other bodies free from all suspicion of poisoning. Gautier of Paris traced these alkaloids to the putrefaction of albuminous substances—fibrin, for example—and Pouchet, his assistant, next discovered a very poisonous alkaloid in normal urine. A signal service in this connection was rendered by Brouardel and Boutmy, who discovered a test by which these cadaveric alkaloids or ptomaïnes may be distinguished from the alkaloids of vegetable origin. This test may be briefly described by the statement that the ptomaïnes, added to ferrocyanide of potassium and perchloride of iron, yield prussian blue.

The clinical application of the above facts was first made by Bouchard, who began by searching for the alkaloids in the urine in cases of infectious disease. He succeeded in finding them in appreciable

quantities in typhoid fever, pneumonia, infectious pleurisy, and infectious icterus, whereas in normal urine but traces of them could be detected. Later, he found the same alkaloids in the fæces in much larger quantity, and was able to demonstrate that their amount is in proportion to the activity of the intestinal fermentations.

It is now established that these substances, the toxicity of which is thoroughly proved by experiments on animals, are greatly increased in typhoid fever, and it is held by many clinicians that they are largely responsible for the group of symptoms known as "typhoid." This view is corroborated by the effect of certain drugs which, while exerting an antiseptic action on the intestinal contents, mitigate or abolish the symptoms referred to. That these drugs destroy the toxic intestinal alkaloids is a well-known chemical fact—that they exert a most favorable influence upon the course of typhoid fever is admitted by all who have given them a thorough clinical test.

Thymol.—The best of these medicinal agents is thymol. In every case in which I have employed [1] this drug in an early stage of the disease the tongue has become rapidly clean and moist, and has so continued; tympany has speedily subsided or has never made its appearance; diarrhœa has diminished, without being followed by constipation; there has been no delirium; and, finally, the temperature has gradually subsided and remained within moderate bounds. In a word, my experience has convinced me that the typical symptoms of typhoid fever will rarely develop if thymol is administered during the first week of the disease. The virtues of thymol are explained on the principle of intestinal antisepsis. In the first place, its antiseptic power is four times greater than that of carbolic acid, and its poisonous effects ten times less. Secondly, it is so insoluble as to reach the small intestine, and there exert its powerful antiseptic effect. As I have elsewhere stated, the fact that thymol is an intestinal disinfectant is proved by the disappearance of phenol from the urine of those to whom it is administered. This substance is one of the most constant products of intestinal decomposition, and is eliminated for the most part by the urine, where it is found even in health; and experimental therapeutists regard its amount in that fluid as a test of the efficacy of an intestinal antiseptic.

Owing to its insolubility and its pungent, burning taste, thymol must be given in pill form. There are theoretical objections to prescribing pills in typhoid fever, but practically they are without foundation, especially if the pills be freshly prepared. The best excipient for thymol is medicinal soap. As to the dose, I have never given more than 40 grains in twenty-four hours—two $2\frac{1}{2}$-grain pills every three hours—and usually give but half this amount. It has, however, been

[1] *Transactions of the Association of American Physicians*, 1888.

given with perfect safety in much larger doses; for example, by Bozzolo as a vermicide in cases of ankylostomiasis, in amounts of nearly ten grammes (ʒiiss) daily. In prescribing thymol the patient should be directed to swallow several mouthfuls of water after each pill to ensure its rapid passage through the fauces and œsophagus, for if arrested in these parts it gives rise to a very disagreeable burning sensation. This is the only precaution to be observed in its use, but it is an important one. I prefer prescribing thymol in gelatin-coated pills, provided alcohol is not taken at or near the same time, for, as already stated, the effect of alcohol upon gelatin is to harden and render it insoluble.[1]

Naphthalin.—This is another intestinal antiseptic of approved value, for the use of which in typhoid fever we are indebted to Rossbach, whose claim that it has an abortive effect on the disease has been recently supported by the observations of Wolff of Philadelphia.[2] The latter recently treated 100 consecutive cases with naphthalin at the German Hospital, with a mortality of 10 per cent. Of the patients, 56 were males and 44 females; their average age was 24.7 years, and the mean duration of the febrile period was 24.4 days. "A notable fact is that in the 100 patients so treated 16 cases ran an abortive course—*i. e.* they defervesced before the end of the second week." Although there were 10 deaths in this series of cases, Wolff claims that the mortality did not, in reality, represent more than 2 per cent. of those treated with naphthalin, for the reasons that 2 cases were comatose on admission and died three days later, and 4 succumbed to complications—viz. facial erysipelas, glosso-pharyngeal paralysis, acute pulmonary phthisis, and heart failure, the result of valvular disease. "Of the 4 remaining cases, 2 died respectively within four and five days after admission, never having responded to treatment." Wolff believes that the undoubted antiseptic effect of naphthalin is due to its conversion into naphthol in the intestine. This chemical change is supposed to be effected by the agency of hydrogen peroxide, which is constantly present in the small intestines.

Recent researches of Schrwald,[3] however, corroborate the view of Fischer, that the disinfecting power of naphthalin is not so much due to the solid drug as to the gas which it freely evolves at the body temperature.

The dose of naphthalin, like that of thymol, is not a fixed quantity. In cases of intestinal catarrh Kraemer[4] obtained excellent results with

[1] I have recently ascertained that DaCosta employed thymol in the treatment of typhoid fever in 1883, prescribing it in from ½ to 1 grain doses. (See *Transactions of the College of Physicians of Philadelphia*, 1882, p. 234.)

[2] *Medical News*, May 23, 1891.

[3] *Berliner klin. Wochenschrift*, 1889.

[4] *Ibid.*, Jan. 18, 1886.

daily doses of 1 gramme (15 grains), whereas Wilcox[1] believes that failure in similar cases has been due to insufficient doses, and declares the administration of less than 60 grains daily to be a "needless waste of a very good medicine."

During the use of naphthalin the urine becomes of a dark, almost black, color, but this fact is of no evil significance. It should, however, be predicted to the nurse and patient. As to any unpleasant effects from the drug itself, these are almost invariably due to the fact that it is impure. When administered with ordinary care the worst that can happen is occasional burning pain in the urinary passages, and to refuse to employ the remedy on that account would be, to quote Rossbach, about as sensible as to banish iodine and potassium iodide from therapeutics because now and then they give rise to acute coryza and palpitation of the heart. Naphthalin may be given in powder or capsule or suspended in mucilage. Finely-ground coffee is a good vehicle when it is prescribed in powder. It may be advantageously prescribed in starch capsules, with a little oil of bergamot to conceal the unpleasant odor, as suggested by Wilcox and as previously employed by Rossbach.

Calomel.—At the present day this is the only purgative that is given with the object of producing a specific effect upon the course of typhoid fever. For this purpose it is usually given as recommended by Liebermeister—*i. e.* three or four 8-grain doses are administered in the course of twenty-four hours and at an early period of the disease, before the stage of intestinal ulceration has been reached. The effect of this medication is, naturally, to produce free purgation, which, however, soon subsides. Calomel is not contraindicated by the presence of diarrhœa. Liebermeister's statistics demonstrate that calomel exerts a favorable effect upon the course of typhoid fever, lessens its duration, and diminishes its mortality. Most of those who prescribe calomel in typhoid fever probably do so on account of its purgative action, by which offending material is expelled from the intestine; while others are content to employ it because it has been empirically proved to be beneficial. Late bacteriological researches have enabled us to give a reason for our faith in this drug by proving it to be an intestinal antiseptic. A series of experiments performed in the laboratory of Hoppe-Seyler by Wassilief[2] demonstrated calomel to be both antiseptic and aseptic in its action—*i. e.* it not only prevents the development of micro-organisms in culture media, but destroys those already present. It has, however, no special influence upon fermentations, such as the digestive, produced by the action of unorganized ferments or enzymes.

Sehrwald has shown that calomel and naphthalin do not destroy the

[1] *St. Louis Med. and Surg. Journal*, 1887, March.

[2] *Zeitschrift für Physiologische Chemie*, vol. vi., 1882.

same microbes in the intestine of typhoid patients, but exhibit decided preferences in this respect. Naphthalin is especially inimical to the bacillus of Eberth, while the other fecal bacteria are attacked by calomel. The inference, especially of those who, like Schrwald, regard typhoid fever as due to a mixed infection, is that both of these drugs should be administered as early as possible in the course of the disease.

Salol, charcoal, iodoform, creasote, iodine, carbolic acid, sulphocarbonated water, and still other substances have been used, and, it is claimed, with benefit, as intestinal antiseptics in typhoid fever. They are, however, in my opinion, inferior for various reasons to thymol, naphthalin, and calomel. An intestinal antiseptic, according to Bouchard—and there is no better authority—must be more or less insoluble and exert no toxic action on the organism. This definition excludes salol, which no sooner comes in contact with the alkaline secretions of the intestine than it splits into carbolic and salicylic acids, both of which are rapidly absorbed; as well as all the other substances last mentioned, except charcoal, which to produce an antiseptic effect in the intestinal contents must be employed in practically impossible doses.

Mineral Acids.—The testimony in favor of the beneficial effect of the mineral acids is decidedly convincing, and is in strict accord with our knowledge of the digestive function and its febrile derangements.

The well-known antiseptic property of the gastric juice is probably wholly due to hydrochloric acid, which substance is either greatly diminished or entirely absent in general febrile states and in gastric catarrh. Now, in typhoid fever we frequently have a combination of fever and catarrh of the stomach, and under such circumstances the food must either be predigested or its digestion rendered more effective by the administration of hydrochloric acid. If food passes from the stomach into the intestine without having been acted upon by the gastric juice, it will certainly undergo abnormal fermentations. These may be prevented by the administration of HCl, which, therefore, may be regarded as an indirect intestinal antiseptic. I am in favor of the routine administration of this acid in typhoid fever, not because I believe it to exert any specific action on the course of the disease, but solely to supply a defective ingredient of the gastric juice.

Turpentine.—This substance, at one time much employed in this country in the treatment of typhoid fever, has been supplanted by more effective agents. It was in great part owing to the impressive teachings of the late Professor George B. Wood that turpentine came into such general use in this disease. Wood believed it to exert a specific effect on the intestinal ulcerations, and found his chief indications for its employment in a dry brown tongue with marked abdominal symptoms. In a case properly treated from the beginning these

symptoms are scarcely ever seen, so that, admitting the efficacy of turpentine, the field of its action should be very limited.

Nitrate of Silver.—Although this drug has not been proved to possess an antiseptic action upon the intestinal contents, and, on account of its great solubility and ready decomposition, must be excluded from the class of intestinal antiseptics as defined by Bouchard, it has been given, with apparent success, to accomplish the same object for which those agents have been so successfully administered. One of the first to employ nitrate of silver in typhoid fever was Joseph Bell[1] of Glasgow. "In some very bad cases," he says, "I have used with advantage nitrate of silver, in doses of from 1 to 3 grains, made into a pill with crumbs of bread, and given every six or eight hours." He evidently considers this treatment to partake of the heroic nature, for he continues: "Such patients are placed in a desperate condition, and require energetic treatment to prevent their destruction." Whether he succeeded in preventing it does not appear. Trousseau employed nitrate of silver in typhoid fever merely to combat diarrhœa, giving it in doses of 1 centigramme every hour. Probably no one has had so large an experience with this drug in typhoid fever as Professor William Pepper of Philadelphia, who some years ago treated a series of 100 consecutive cases without a death. In reply to my inquiry concerning these cases, Dr. Pepper, in a letter dated April 25, 1891, has kindly given me the following details: "The series was of 100 cases treated in private practice, and there was not a single death. Most of the cases were seen at the very onset, though a certain proportion were seen in consultation after the disease was fully established. In all cases nitrate of silver was administered from the earliest moment at which the nature of the disease was suspected until the entire close of the process. It was nearly always given in pill form and in doses of one-fourth and one-fifth grain. If there was diarrhœa a small dose of opium was combined, and if the bowels were quiet or disposed to be constipated a small dose of belladonna was substituted. Absolute rest and strictly liquid diet were insisted upon. These constitute the staple of the treatment. In certain cases alcohol, quinine, turpentine, or carbonate of ammonium were given to meet special indications. High temperature was relieved by occasional large doses of quinine or by cool sponging. The series extended over a considerable period, and many of the cases were of great severity."

In a later communication Dr. Pepper says: "I have been so fully convinced of the value of nitrate of silver as a constant element in treatment of typhoid fever that it has for many years been my invariable practice to employ it from the earliest hour that I see a case in which there is even a suspicion that it will prove to be one of that dis-

[1] *Glasgow Medical Journal*, vols. vii., viii., and ix., 1860.

case. I continue its use throughout the entire course of the case. It is very rarely that I abandon it. I do not hesitate to associate with it any other remedy as indications may require. I can say with confidence that I have never lost a case of typhoid fever in private practice, where I have been called at the beginning of the disease, since I have adopted this treatment. This statement covers a period of at least ten years, and of course refers to a very large number of cases, although I am sorry to say I have allowed myself to be drawn into so many collateral matters that I have been prevented from keeping proper records."

It will, of course, be observed that this remarkable success was achieved in private practice, and that Dr. Pepper makes no allusion to his hospital cases, which during the period referred to must have been very numerous. Still, making all allowance for the great advantages of early treatment and previously good physical condition, which are the chief characteristics distinguishing private from hospital cases, it must be admitted that his favorable results are largely due to the hygienic, dietetic, and medicinal treatment to which his patients were subjected.

Alcohol is no longer given as a matter of routine in typhoid fever, but only to meet special indications, which, as a rule, do not arise before the end of the second week. The previous habits and age of the patient are the chief factors in determining whether alcohol is to be given or not. Most persons under thirty years of age, previously temperate, if placed under proper treatment during the first week will do better without alcohol. The previously intemperate require decided doses of alcohol from the start, which must be increased, as a rule, as the disease progresses. Patients over forty years of age, of previously temperate habits, will generally be benefited by a moderate amount of wine or whiskey during the entire course of the disease. By a "moderate amount" I mean about three ounces of whiskey—half an ounce every four hours—during the twenty-four hours. In all cases attended with marked nervous symptoms, such as low, muttering delirium, subsultus tendinum, and restlessness, alcohol should be tentatively prescribed, and continued or not in accordance with its effects. If the patient becomes more tranquil under its use, and especially if the pulse, previously rapid, soft, and dicrotic, gains in volume, strength, and tension, and loses in frequency, its action is undoubtedly beneficial. No rule universally applicable can be formulated with reference to the administration of alcohol in typhoid fever, although it seems to exert its favorable effects more frequently when the skin is moist, or even "leaky," than when it is hot and dry. It matters little in what form the alcohol be administered, although I have a preference for good, sound whiskey. When there is a decided tendency to looseness of the bowels a wine rich in tannin should be substituted for the whiskey.

Treatment of Complications.

The principal complications of typhoid fever are referable to the digestive system, and include excessive diarrhœa, tympany, intestinal hæmorrhage, and perforation of the bowel.

A moderate diarrhœa need not be interfered with. By "moderate," as here employed, I mean from three to six gruel- or mush-like stools in the twenty-four hours. If the number exceeds six, and especially if the discharges become watery, measures to control them should be adopted. Among the most efficacious means for this purpose are opium suppositories, acetate of lead, gallic acid, nitrate of silver, sulphate of copper, and salicylate of bismuth. Of these drugs I have found the last in 5-grain powders every three hours decidedly the best, and this I attribute to its well-marked antiseptic properties.

I have not seen, in my own practice, a case of typhoid fever with excessive meteorism for several years. When, however, this complication has been allowed to supervene, it may best be treated by the application of cold compresses to the abdomen, and by charcoal and alcoholic stimulants internally. These failing, an enema of cold water may induce contraction of the intestinal parietes at the same time as it mechanically dislodges and expels some of the accumulated gas. As a last resort a rectal tube may be carefully inserted and pushed upward as far as possible.

Intestinal hæmorrhage is best combated by the administration of ergot, both *per os* and hypodermically, and also by the application of ice-cold compresses to the abdomen. While extract of ergot is given hypodermically, astringents, such as acetate of lead and gallic acid, may be given by the mouth. At the same time, all warm drinks should be withheld, and absolute bodily rest maintained.

Perforation of the bowel calls for the use of large doses of opium, after the plan originally advocated by the late Professor Alonzo Clark of New York. There is no rule as to dose, the drug being pushed to the point of tolerance. A grain of opium, or its equivalent in morphine, may be given every hour until the respirations are decidedly reduced in frequency; for example, to twelve per minute or even lower. At the same time, all nourishment is withheld except water, and this only in the shape of small pieces of ice occasionally. In case of recovery the bowels should be kept confined for a week or more after the symptoms have subsided. The only authenticated recoveries from perforation of which I have any knowledge were treated with opium. Laparotomy for this accident is, I believe, useless. I am hardly prepared to call it unjustifiable, but I believe the chances of recovery, slight as they are, are greater under purely medical treatment. Besides, there is always the possibility of a mistake in diagnosis, for peritonitis arising in the course of typhoid fever may be due to

other causes than intestinal perforation; for example, to direct extension of inflammation from the base of an ulcer, to hæmorrhagic infarction of spleen or kidney, or to rupture of a softened mesenteric gland. The peritonitis resulting from such accidents has doubtless been frequently attributed to perforation of the intestine.

Hypostatic congestion of the lungs is the most frequent complication of typhoid fever, and is due to the combined influence of a weak circulation and a recumbent posture. It is best avoided by frequently changing the position of the patient, so that his decubitus shall be, on the whole, rather lateral than dorsal. Deep respirations, such as are taken in cold baths on the first shock of entering them, as well as those induced by cold sponging, are the best prophylactic and curative agents as regards this condition. In addition, the strength of the circulation should be maintained by stimulants judiciously employed, as well as by strychnine, which, in doses of from $\frac{1}{30}$ to $\frac{1}{50}$ grain three or more times daily, is an excellent cardiac and respiratory tonic.

Pneumonia or pleurisy occurring in the course of typhoid fever I regard as intercurrent affections rather than complications. Their treatment under these circumstances demands more strongly than usual the judicious use of stimulants and the avoidance of depressing measures, among which I include blisters.

The complications involving the circulatory system are cardiac weakness, hæmorrhage, and thrombosis. The strength of the heart's action is best indicated by the duration, the pitch, and the intensity of the first sound. When the two sounds of the heart closely resemble each other—*i. e.* when the duration of the first sound is shortened and its pitch raised—it is evident that its strength is failing, but whether from the mere strain of long-continued over-exertion or from granular degeneration of its fibres is not always easy to determine. If after a few doses of stimulants the normal relation of the two sounds is restored, the condition is probably chiefly due to fatigue; if, however, the heart's action continues rapid and feeble after the use of stimulants, and especially if there is little difference in the character of the two sounds, it is highly probable that some degeneration of its muscular fibres has occurred. This condition is completely recovered from with time, although it may manifest itself by undue cardiac irritability for months after recovery. It is claimed, and with apparent justice, that cardiac and other parenchymatous degenerations are prevented by a properly-conducted antipyretic treatment.

The most constant form of hæmorrhage is epistaxis, which is best controlled by the application of ice-cold compresses to the bridge of the nose and forehead, and by injecting astringent substances into the nares. A solution of alum or tannin is usually efficacious, and excellent results have been obtained by the injection of pure lemon-juice. Internally

or hypodermically, ergot may be given at the same time. These measures failing, the posterior nares may be tamponned, but it is extremely rare for this *dernier ressort* to be necessary.

Thrombosis, like pneumonia, is rather an intercurrent affection than a true complication. Like the pulmonary congestion, it is caused by the sluggish state of the circulation, and therefore requires the same prophylaxis. It is limited, as a rule, to the large veins of the lower extremities, and is much more common on the left side than on the right. This is explained by the fact that the left common iliac vein is crossed, and presumably compressed, by the right common iliac artery. Thrombosis is a late accident, not appearing before the third or fourth week, or, more commonly still, during convalescence. Its treatment consists in absolute rest and hot fomentations, followed, when pain and tenderness have subsided, by bandaging. It is completely recovered from, as a rule, but the danger of the detachment of a fragment of clot and its embolic obstruction of the pulmonary artery is always present in the early stages of the affection.

Parotitis is treated on general surgical principles. It is believed by Strümpell that this accident may be prevented by careful and repeated cleansing and disinfection of the mouth, from which cavity he believes the germs of inflammation and suppuration find their way along Steno's duct to the parotid gland.

Mental disturbances occasionally manifest themselves during convalescence, and may persist for an indefinite period, although their duration is, as a rule, not more than one month. It is very rarely the case that the derangement lasts longer than three months. Complete restoration to mental health is the rule in these cases.

I say nothing about the management of bed-sores, because their existence is proof positive of defective medicinal treatment and careless nursing. A bed-sore has no legitimate place in the clinical history of typhoid fever. It is neither a complication nor an intercurrent affection: it is a blunder.

Management of the Stage of Convalescence.

Péter has said that the convalescent stage of typhoid fever may almost be regarded as a disease by itself—"presq'une seconde maladie;" and, so far as its management is concerned, this is undoubtedly true. It is at this time that the patient, beginning once more to feel himself "his own master," is himself mastered by the imperious demands of appetite. In a hospital with well-trained nurses the management of this stage is a comparatively simple matter, but in private practice, where the physician has so often to deal with the indulged and the self-indulgent, his tact and patience may be tried to their utmost.

The stage of convalescence may be said to have fairly begun when the evening temperature has reached the normal point for two successive days, the morning temperature being also normal. Even before this period the patient may have been clamorous for solid food, receiving instead nothing but "fair words," which are proverbially insufficient articles of diet. The time has now arrived when the diet of a healthy man is to be gradually resumed. In addition to the milk, which still constitutes the staple article of diet, a poached or soft-boiled egg may be allowed for breakfast and a little milk-toast for supper. The next day the egg may be repeated in the morning, some chicken-broth, thickened with well-boiled rice, given for dinner, and some corn starch for supper. The patient, if all has gone well, is now perfectly ravenous, and the third day may combine the egg and milk-toast at breakfast, and be allowed the soft parts of six or eight oysters at dinner, with the addition of a glass of sherry or half a tumbler of ale. In the evening the inevitable milk-toast is repeated, and between these meals milk may be taken *ad libitum*. A little boiled chicken may be added next day or a sweetbread, and thus by degrees the approaches are made toward the much-wished-for mutton chop, beefsteak, and mashed potatoes. The latter articles, however, should not be permitted until the temperature has remained normal for about ten days, the interim having been filled up with chicken, fish, sweetbread, partridge, and eggs in various culinary forms.

As to the time of sitting up, it is a safe rule to keep the patient in bed for a week after the temperature has reached and remained at the normal point.

During the first three weeks of convalescence—and even much later when the attack has been unusually severe—the temperature and circulation of the patient are characterized by great instability. Even the act of digesting solid food at first causes the temperature to rise. I have repeatedly observed this *febris carnis*, as it has been called, and I would suggest that it be called *febris cibi*, as solid food of any kind may occasion it in the first week of convalescence.

The patient is also extremely emotional at this period, and therefore all news of an exciting character should be withheld from him as long as possible. Every day of tranquillity brings him greater strength to bear the inevitable burdens of life.

Convalescence is often promoted by stimulants, even in cases where they have not been administered during the fever. A glass of burgundy, or, better still if relished, a mug of Bass's ale or Guinness's stout, is one of the best of tonics at this time. A convalescent from typhoid fever is always anæmic. The condition of the blood is similar to that which obtains in chlorosis, but this does not necessarily imply that the deficient hæmoglobin is to be restored by the administration

of iron. If the digestion is good the patient will soon assimilate all the iron he needs from the beef and mutton he is devouring. If the anæmia continues, a change from the city to seashore or mountain should be advised, and may be combined with the use of iron internally. A ferruginous mineral water is the best vehicle for iron under these circumstances.

I have made no reference to the numerous affections that have been described as "sequelæ" of typhoid fever, nor do I intend to do so, because the majority of them have nothing to do with the so-called primary disease, except that they follow it. It is undoubtedly the fact that the convalescent stage of typhoid fever is one of great physical susceptibility. The exemption from one infectious disease that has been conferred upon the patient is at the price of a temporary increased liability to other affections.

In concluding this article, which I have limited to a description of the principal methods now in vogue in the treatment of typhoid fever, I can heartily indorse the quotation with which Dujardin-Beaumetz ends his chapter on the same subject: "*The best treatment of typhoid fever is a good physician.*"[1]

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[1] "Le meilleur traitement de la fièvre typhoïde est un bon médecin."

TYPHUS FEVER.

By MANUEL DOMINGUEZ, M. D.

Typhus, petechial fever, or *tabardillo* as it is commonly called in Mexico, is a contagious febrile disease, endemic over nearly all the country, with exacerbations of an epidemic form occurring at the beginning of summer and in winter; a disease that gives to the person attacked by it a probable future immunity; that is developed with some symptoms similar to those observed in typhoid fever, and in every way identical with those exhibited by the contagious ship- or jail-fever of the English, but the essential cause of which is entirely unknown.

I call this fever contagious, contrary to the opinion entertained by many of my colleagues, who absolutely deny it that character; and to that of others, who, while admitting the classical distinction between infection and contagion, place it only among infectious diseases, or, at most, regard it as infecto-contagious. In my opinion, contagion is characterized by the transmission from one organism to another of a special miasm. This organic element has the property of thriving in the new field, of multiplying itself, of giving rise to the same disease of which it is the characteristic germ, and of never losing this power of self-transmissibility. On the other hand, infection consists in the absorption of a miasmatic agent which lives, develops, and dies in the new organism to which it has been transmitted. Bearing this distinction in mind, typhus fever and allied affections may properly be placed among contagious diseases, while intermittent fevers, for example, may be classed among the infectious disorders.

Having said that typhus is endemic throughout Mexico, I will further state that its special habitat is in that region of the country known as the Central Tableland. In regard to this point M. Jourdanet has asserted before the Mexican Academy of Medicine that *typhoid* fever, and *not typhus*, is the disorder most commonly observed in Yucatan, the most prominent symptoms being those of a severe diarrhœa and other intestinal lesions; that the same may be said of the fever occurring in the state of Tabasco and along the coast of the Gulf of Mexico; and that, in his opinion, all those towns situated on the sea-level prob-

ably nurse the same affection. In support of this idea the distinguished observer just mentioned added that "typhus fever, in the eastern portion of the country, only reached as far as Orizaba, without even penetrating Vera Cruz," pointing to the curious fact that "the two types of febrile disorders most common in this part of the world, typhus and yellow fever, each exercise a power over a certain territory, one never invading the dominion of the other."

Be this as it may, I will affirm that over its own territorial dominions typhus fever occurs in the country as well as in the large towns, and in the rural districts surrounded by the purest air as well as in the filthy alleys of the most uncleanly city.

Typhus fever in the Mexico of to-day is not of modern origin. There is no doubt that the ancient epidemic called by the Mexican Indians "*matlazathuatl*," and which produced such terrible ravages during the years 1546, 1576, and 1736, was caused by no other disease than petechial fever of an entero-hæmorrhagic form. According to Torquemada, 800,000 Indians succumbed to the disease in 1546, this figure being increased to 2,000,000 during the year 1576. From those remote periods to the present time the frequent transmissions from one organism to another have diminished greatly the virulence of the contagion. Even in its periodical exacerbations, during which the fever assumes an epidemic form of a greater or less severity, the mortality is comparatively small. During the epidemic of 1812 the mortality was 60 per cent., which, added to political convulsions, produced a high death-rate among the inhabitants. In the years 1813, 1814, 1823, and 1839 even the relative recrudescences of typhus fever produced great alarm in all classes of society, notwithstanding the fact that the number of deaths had already largely diminished. At present the endemic form of the disease, occurring at the seasons previously referred to in this article, has a mortality varying from 20 to 25 per cent. among those attacked by it, including persons of all ages and sexes, and one of from 50 to 60 per cent. when the disorder takes an epidemic course. I may here mention that the mortality is always greater among the higher classes of society, and it seems as if the scourge were a sworn enemy of civilization.

The germ peculiar to this disease is yet to be discovered. Notwithstanding the earnest studies and profound researches of many of our most eminent investigators, the true nature of the cause of the fever remains at the present time entirely unknown. There undoubtedly exists a special miasm; but is this the result of organic animal decomposition? or, as Montano believes, is it the same micro-organism that causes the different types of intermittent fever? The existence of many well-authenticated cases of spontaneous typhus fever opposes both theories, while there are other cases still in which it is impossible

to attribute the disease to any cause. It is not rare to meet with healthy individuals, of previously sober habits and faithful observers of the strictest rules of hygiene, suffering with typhus fever, in whom the terrible disease plays havoc, exhibiting in the most severe form all its characteristic symptoms and signs.

Among the predisposing causes of typhus fever may be mentioned —1. Insolation, especially when the individual exposed has allowed damp clothing to dry on his body; 2. Indigestion, in which case the presence of the disease may be attributed to an auto-infection. 3. Overcrowding of people in close apartments vitiated with a foul atmosphere; 4. Impure drinking-water; 5. Decomposed food; 6. Cadaveric emanations; 7. Miasms originating in water-closets, cess-pools, or other similar sources.

All these causes give rise to typhus fever, but if it is remembered that in many instances persons exposed to them remain free from the disease, it may be held, reasoning *a priori*, that a certain predisposition peculiar to the individual organism is absolutely necessary for the development of the special typhus germ.

In Mexico the indigenous race, ill-fed and almost nude, uncleanly from lack of education, subject to the direst poverty and a hard-working-life, exposed almost constantly to the inclemency of the weather, or obliged to inhabit small, badly-ventilated, damp, and pestilent huts,—such a race, I repeat, has lost its robust physique and vigor of old, and degenerated into a people of a feeble constitution, so that they are adapted to the ravages of all infectious disorders.

Typhus fever, as I have already remarked, can be transmitted by direct or indirect contagion—that is, by personal contact—through the medium of the different secretions, such as the breath, the sweat, and the fæces, or through the clothing and the surrounding air. This transmissibility is not to be compared to that of other zymotic disorders, such as measles, scarlet fever, and small-pox, but there is no doubt that typhus fever occurs similarly, if we notice the many cases reported in our medical literature. This mode of transmission, however, is denied by certain biassed observers in whose opinion evidence itself has no weight.

With a few variations typhus fever has the following onset: A more or less intense chill, assuming at times an intermittent form; great physical depression, accompanied with general *malaise;* supraorbital cephalalgia, usually lasting to the end of the second week; stupefaction and vertigo; a more or less pronounced anorexia; wakeful sleep; and an abrupt elevation of temperature, which is always increased toward evening. Sometimes there are nausea and vomiting, and pain over the abdomen is frequently complained of. In the majority of cases epistaxis is present, and generally appears on the third day after the infection.

These signs exhibit a decidedly progressive course, but neither their intensity nor their persistence is sufficient to characterize the disease under consideration. On the fifth day after the invasion, marked by the initial chill, the peculiar typical eruption appears. This eruption may be considered as an unequivocal, pathognomonic sign of the disorder. From this moment, which may properly be looked upon as the period of effervescence, the train of symptoms may be described as follows: Stupid expression of the face; marked injection of the conjunctiva; a frequent pulse, ranging from 100 to 120 per minute; a dry, burning skin, with a surface temperature of from 40° to 41° C. (104° to 106° Fahr.); a broad, whitish, and decidedly dry tongue; ringing of the ears and deafness; constipation (diarrhœa in exceptional cases), and a concentrated urine diminished in amount; mental wandering or total indifference of the patient toward everything that surrounds him; painful spots over the abdomen, and on the epigastrium the existence of the characteristic eruption in the form of petechiæ. These petechiæ were by Jimenez likened to flea-bites, from which they may be differentiated, however, by the absence of the central hæmorrhagic point produced by the insect, and by being slightly elevated. This eruption may properly be compared to that of rubeola. The spots momentarily disappear on pressure; from the third to the fourth day they are transformed into true petechiæ, and persist from the sixth to the tenth day. From the hypogastrium, on which this exanthema first appears, the eruption gradually spreads over the body, with the exception of the face, the palms of the hand, and the soles of the feet, becoming more and more confluent, and finally taking the form of irregular patches. *Pari passu* with the appearance of this eruption, there is exhaled by the patient a special characteristic odor—an odor which my great teacher, Jimenez, was in the habit of comparing to that given off by the domestic mouse. That observer considered this peculiar odor of paramount importance, as he was never able to perceive it in those fevers which accidentally assume the typhoid form.

This train of symptoms increases in severity from day to day. The lips and the teeth in the course of time are covered with sordes; the tongue, which acquires a cylindrical shape, appears dry and is covered by a brownish coat. The meteorism caused by inertia or paralysis of the intestines increases, and the constipation becomes more pronounced. The expulsion of urine is involuntary or the liquid is entirely retained, the bladder becoming enormously distended. The epistaxis, which may at times be overlooked, is present, and often so abundant as to require tamponing of the nasal fossæ. The petechiæ, signs of capillary hæmorrhage, and produced by the blood in a state of decomposition, are now found in different parts of the body, especially on the trunk. The temperature is high, 39° to 41° C. (102°

to 104° Fahr.), with a slight morning descent. The frequency of the pulse ranges from 100 to 140 per minute. Then there comes delirium, sometimes of a tranquil character, marked by a slight disturbance of intellection; at other times it is exalted, furious, simulating an acute attack of mania, revealing a clear perversion of the cerebro-spinal functions. This ataxic form of typhus fever is the most dangerous, producing the greatest number of deaths, these being usually preceded by a profound coma. The most common form of the disease, however, is the adynamic type, occurring ordinarily in old people and debilitated adults. It is characterized by profound collapse, a compressible pulse, the frequency of which bears no relation to the temperature. These symptoms are followed by certain ataxic movements, dependent, however, on the adynamic condition of the patient, and by a perceptible coldness of the surface of the body, which is progressive till the occurrence of death.

In children typhus fever exhibits a special form. It is usually characterized by a period of invasion, in which the following symptomatology is noticed: cephalalgia, more or less elevation of temperature, and complete prostration. In the second period, or that of effervescence, the eruption is temporary, presenting a discrete form, but sometimes it is totally absent. In the second week a frank convalescence, without complications, sets in.

In adults, even if ataxic phenomena should appear during the course of the second week, typhus fever has a tendency to assume the adynamic form, and death often occurs on the disappearance of the fever—at a time, indeed, when it is expected that convalescence should begin.

As is the case with the enteric fever of Europe, in Mexico typhus fever is frequently complicated with pulmonary congestion—a condition which lacks the importance and severity pertaining to that of the first-named disorder. There is sufficient reason for the belief that this congestion in typhus is wholly hypostatic, owing to the tendency of patients to assume the dorsal posture.

In typhus fever, it is safe to assert, constipation is the rule, but this does not entirely exclude the existence, at times, of diarrhœa, especially during the last stages of the disease, when the evacuations become involuntary.

A very rapid pulse is an unfavorable symptom. Jimenez used to say that "there is no worse augury, in the advanced period of the disease, than a concentrated pulse, the frequency of which gives to the beating artery under the finger the character of a soft and loose cord in continuous vibration."

In fatal cases delirium is frequent, but this is absent in the benign form of the disorder. It is worthy of note that this delirium is not

generally of a wild nature. When spoken to under such circumstances the patient will answer intelligently, as if mind and judgment were in a normal state. The delirium and subsequent coma are sometimes accompanied with spasms. If these spasms continue and become generalized, they point to a fatal termination.

The gurgling sound in the right iliac fossa, so frequently observed in typhoid fever, is extremely rare in typhus; it is only noticed when the patient is purged or when diarrhœa is present. In such cases this gurgling sound is observed not only in the right iliac fossa, but also in other regions of the abdomen; which clearly shows that it is produced by the conflict, so to speak, between the liquids and gases contained in a tube that has for some reason or other lost its physiological tonicity. The symptom should by no means be considered as pertaining to typhus fever. The eruptive spots are so frequent and appear in such great numbers that the designation of *petechial* fever, given to the disease by many authors, is not a misnomer. The eruption, it is true, is absent in some cases. Thus in 1886, Liebermann observed in Mexico instances of this nature, and such he pronounced cases of abortive typhus. My friend, Dr. Ollogui of San Juan del Rio, has made similar observations. This fact, nevertheless, in no way diminishes the diagnostic value of the typical eruption. When this sign lacks at the beginning the exanthematous character of the typical roseola, but, on the contrary, presents the petechial form, the prognosis of the disease is unfavorable.

Not uncommonly there occur in typhus fever gangrenous eschars of the skin, especially at the points of most constant pressure, but these accidents are less frequent than in typhoid fever. A more serious accident, and one more frequently met with in typhus than in enteric fever, is gangrene of the abdomen, and of the vulva in women, produced by arterial and venous thrombi resulting from an extremely impoverished condition of the blood.

During the course of the disease the catamenial period may come before its proper time; sometimes it appears as a critical phenomenon. In pregnant women typhus fever is apt to produce abortion or induce premature labor, which are dangerous accidents.

Perforation of the intestines, the subsequent peritonitis, and alvine hæmorrhages are unknown in typhus fever.

The ordinary duration of typhus fever is fourteen days; it rarely goes beyond the twentieth or twenty-fifth day. The difference is noticeable when compared with the enteric fever of Europe, the duration of which is at least thirty days. If our disease passes from the second to the third week without amelioration of the symptoms, the prognosis is exceedingly unfavorable. In the fatal types of the disorder death takes place during the course of the second week.

Typhus fever, whatever the form in which it appears, is always a serious disease. Even in the most benign types accidents are apt to occur that compromise the life of the patient. It is for this reason that the prognosis should always be guarded.

The train of symptoms already described, and the pathological lesions which are found post-mortem, are sufficient to make of typhus fever an affection distinct from follicular enteritis. I hold that there is a certain relationship between the two disorders, but the Mexican *tabardillo* appears to be more closely allied to the *typhus fever* of Edinburgh.

Escobedo and Jecker in the early history of our National School of Medicine, and later on our eminent Jimenez, Hidalgo y Carpio, Ehermann, Jourdanet, my colleague Carmona y Valle, and others, all accept the difference between the two diseases, but these authors are not concordant in explaining the difference. Thus Jourdanet took into consideration the various meteorological conditions of the localities in which the infection originated; Jimenez laid stress on the geographical differences between the continents. Some writers have pointed to the distinct character of the races, while still another class of authors have attributed to each of the two diseases a particular germ as the cause.

Without wishing to place myself on record in regard to the character of the miasm, whether it be the same for the two diseases or a distinct one for each, I am, however, inclined to believe in the latter, basing this belief on the fact that both affections coexist in our soil. This would not be the case if one and the same pathogenic germ were simply modified by our peculiar climate or by the idiosyncrasies of the individual economy receiving it. Again, a person once attacked by our *tabardillo* does not remain exempt from an attack of typhoid fever and *vice versâ*.

Finally, I will state, in support of the duality referred to, that the difference between the two pyrexias is noticeable from the onset of the symptoms. In typhus fever the invasion is violent, marked by a chill; in typhoid there is no chill, as a general rule, and the prodromic period is prolonged. In this latter affection diarrhœa is the rule, while the former is characterized by constipation. Typhus fever lasts commonly two weeks; typhoid fever goes beyond the thirtieth and frequently reaches the fortieth day. In *tabardillo* convalescence makes its appearance in a rapid manner, while in its homologue it comes by lysis. The cutaneous eruption is the most prominent sign of typhus fever; in typhoid fever all other signs are subordinate in importance to the peculiar lesion of the intestinal follicles.

As typhus fever is a highly contagious disease, the miasmatic germ of which is readily transmitted from one person to another through the

atmosphere, the secretions and excretions, the clothing, etc., it is absolutely necessary, in the first place, to isolate the patient and place him under the best hygienic conditions as regards ventilation and cleanliness. It is at the same time advisable to make free use of disinfectants. Curative measures have been as varied as the different theories proposed regarding the origin of a disorder unknown in its very essence. At one time the method of Brown, which consisted in the administration of analeptic agents or invigorating tonics, served only to overcrowd the graveyards. It was followed by the still more terrible depletory medication of Bronssais. This so-called founder of the Physiological School laid a great deal of stress upon the intestinal lesions characteristic of typhoid fever. Our own practitioners of those times, incapable of understanding or appreciating the difference in the essential pathological changes between the two diseases, typhus and typhoid, and considering, besides, the ataxic form of *tabardillo* as an active hyperæmia or inflammation of the nerve-centres, adopted with unbounded faith and enthusiasm the therapeutic plan of the illustrious medical reformer. General and local bloodletting, a vesicant and evacuating treatment, united to the severest diet, became then the remedial system universally adopted in the management of the disease in question. The day came, however, in which the eminent physician Manuel Carpio, by combating energetically and successfully the therapeutic absurdity referred to, rendered a great service to suffering humanity. This great man introduced and advised an evacuating and sudorific medication—a practice which became generalized during several years, but was afterward converted, unfortunately, into a routine system.

The general plan observed to-day in the treatment of typhus fever is that proposed by Hidalgo y Carpio, and called by this observer the "rational expectant treatment." This method consists in combating the symptoms as they appear, being especially careful in keeping up the strength of the patient, in order to render him capable of successfully resisting the natural evolution of the pyretic disorder. In fact, typhus fever is at present unknown in its cause, and is, besides, such an insidious foe that it is not always advisable to use against it the same weapon; on the contrary, the weapons employed should be changed according to the manifestations exhibited by the disease. The evacuating method has the following indications: The catarrh of the stomach, which is frequently observed in many cases at the beginning of the affection, should be managed by emetics, especially by ipecacuanha, which is an innocent drug and does not depress the strength of the patient. Constipation and meteorism can be relieved by means of the mechanical and saline purgatives, as these produce no irritation of the bowels and only give rise to a moderate amount of intestinal action.

The ataxic phenomena require the action of the depresso-motors. These agents consist of the anti-spasmodics, such as valerian, musk, and the bromides of potassium, sodium, and ammonium.

For all adynamic symptoms no better remedies than tonics can be used. Among these may be mentioned quinine and nux vomica, the diffusible stimulants, such as alcohol, which should be given in small doses, and the various wines.

In the special management of hyperpyrexia antipyretic measures are employed. These may consist in the application of tepid- or cold-water baths, and of those general lotions and certain medicinal agents the chief action of which (like antipyrine, for instance) is to reduce an elevated bodily temperature. If the fever occurs in the form of intermittent exacerbations, the salts of quinine are to be preferred, as their effects are both antiphlogistic and antiperiodic.

To render still more clear the therapeutic indications so briefly stated, the following points are to be borne in mind: Contrary to the belief of previous observers, who made the use of purgatives a routine practice, these agents have no special depurative action upon the economy. Such medicaments are employed simply to remove the existing constipation and to relieve meteorism, and as derivatives for certain accidental pathological processes (such as cerebral congestion), and, finally, to avoid the auto-infection to which the patient is exposed owing to the absorption of the alvine discharges retained for a long time within the intestinal tract.

The tepid- or cold-water baths and the general rubbing of the body by means of a sponge act as powerful depressors of calorification. In many cases these measures have given surprisingly good results. The thermometer, it is perhaps needless to say, should indicate the proper time for the application and duration of the bath. Those who systematically use cold water in the treatment of typhus fever keep the patient in the bath-tub until the thermometrical column begins to descend. He is then placed between sheets. If after this procedure the temperature rises, the patient is again submerged. If necessary this is repeated again and again until the abnormal bodily heat is subdued.[1] This method, barbarous though it may seem, and extremely trying to those applying it, has nevertheless given, I repeat, most excellent results, especially in those towns—like the city of Morelia, for instance—where it is very commonly put into practice. I myself have never been in favor of this form of treatment, and much less to-day when we have other therapeutic means with which to keep down the fever; but I verily believe that in those cases in which the hyperpyrexia is accompanied with excitement and delirium no better measure can be employed than the prolonged tepid-water bath. In the

[1] See article on Hydrotherapy, p. 453, Vol. I. of this SYSTEM.

adynamic form of the disease, however, such baths are contraindicated. In these cases tonics and stimulants readily ward off a fatal termination. Then, again, good wines, quinine, cinnamon-water, and the preparations of strychnine are useful weapons to be employed in the hope of obtaining a complete and brilliant recovery.

My own plan of treating typhus fever, which I have been in the habit of using for several years, does not differ greatly from the one just described and at present in vogue by the large majority of Mexican physicians. In the frank and benign type of the disorder I generally employ the expectant treatment, giving slightly acidulated drinks in order to mitigate thirst directly and indirectly to aid digestion. I use, besides, mouth-washes made up of some alkaline solution. I likewise employ cold-water enemata of a decoction of *Illescbram achyrantha*, a preparation known commonly by our lower classes as *tianguis pepetla*, with the object of clearing out the intestines. I prescribe, then, a light diet consisting of eggs, milk, tea, and meat, being careful not to overload the stomach, with the view to keeping up, as far as possible, the strength of the patient, and in the endeavor to avoid the delirium from inanition not unfrequently observed during convalescence.

In the ataxic form of typhus fever, in which there are high fever and continued excitement, I resort to the application of the tepid bath, more or less prolonged, and I administer every half hour 7 grains of antipyrine, the full effects of which must be carefully watched by the aid of the thermometer.

If, however, the disease shows a tendency to assume an adynamic type, I prescribe, from the start, wine of cinchona, frequently repeated according to the requirements of the individual case, or else I have recourse to the use of the tincture of nux vomica by itself or in combination with the wine. If profound prostration or collapse supervenes, as is often seen in senile cases, sulphate of strychnine hypodermically administered is the remedy to be employed. To this may be added dry frictions or rubbing of the body with alcoholic preparations, and the administration also of nutritious enemata.

I can highly recommend this method of treatment, having derived from it great service; but I must here state, to my sorrow, that often in typhus fever the best plan of treatment fails completely in preventing a fatal issue. Typhus fever is a treacherous disease, and often, even during a mild attack, the patient succumbs suddenly to one or another unforeseen accident.

MALARIAL DISEASES AND DENGUE.

By GEORGE DOCK, M. D.

On the Mode of Action of Quinine.

One of the characteristics of malarial diseases, and the most important to the therapeutist, is their susceptibility to cinchona or its active principles. For this reason it will be useful to consider the so-called specific treatment at length before taking up in detail the rational treatment of the various forms of malaria recognized clinically.

Until within a few years a discussion of the action of cinchona or its alkaloids in a practical treatise would have been unprofitable. Owing to the erroneous theories of the pathology of malaria then prevalent, the best explanation that could be made was that "quinine is an antiperiodic, and nothing more."

Now, however, we have a pretty accurate knowledge of the cause, and are beginning to learn something of the nature, of the diseases in question. Moreover, we are able to recognize positively, as malarial, diseases which were until recently obscure in their pathology and diagnosis, and as positively to exclude others heretofore included under that too comprehensive term. For these reasons it is important that we gain as clear an idea as possible of the mode of action of quinine, so as to use with skill and understanding that remarkable remedy, which becomes more valuable in proportion as it is tested.

The modern explanation of the antimalarial action of quinine is substantially that advanced by Binz more than twenty years ago. That is, that it depends on a poisonous influence over the protoplasm of the organisms which cause the disease; in a word, that it is an antiparasitic.

We know now that the various phenomena of malaria are caused by organisms existing in the blood in such cases, first described by Laveran,[1] but most commonly known by the name given by Marchiafava and Celli[2]—*Plasmodium malariæ*. These organisms belong to the Protozoa, the lowest animal beings. Their exact classification is not yet possible, but in their vital manifestation they resemble the

[1] *Du Paludisme et de son Hématozoaire*, 1891.

[2] See Celli and Guarnieri, *Fortschritte der Med.*, 1889, Nos. 14 and 15, for defence of the name.

monads, the sporozoa, and allied forms. In the blood, and for the most part in the red-blood corpuscles, they carry on a cyclical existence, beginning as spore-like bodies, and going on through an amœboid to a segmenting, reproductive stage. We know from the observations of Golgi, abundantly confirmed, that there is a close connection between certain phases of the development of the parasites and the periodic processes in the affected individual. Some of the morbid changes in malaria are traceable to a direct action of the parasites. Such are the destruction of red-blood corpuscles and pigment-formation. Others, not so easily studied, are probably brought about through the agency of the nervous system.

When an individual with malarial fever recovers, either spontaneously or under the influence of remedies, the following changes regarding the parasites take place: The amœboid or actively-growing forms disappear from the peripheral blood, and only large forms, with a few of the smallest, are left. Among the last to disappear are the flagellate bodies (the crescentic forms not being considered, as they are neither constant nor essential), and although it is not certain, as held by some, that these represent purely cadaveric changes, they, as well as the large non-flagellate free bodies, are prone to exhibit changes unmistakably related to their dissolution. Neither these nor the small forms reach the later stages in the event we are now considering.

In spontaneous or natural recovery we assume that the tissues or fluids, or both, of the host have overcome the parasites, or that the latter have been killed by their own metabolic products. Some or all of these processes must take place with the maturing of each generation of the organisms, or, as Plehn has pointed out,[1] as the parasites increase from ten- to fifteen-fold, the individual would be overcome in a few paroxysms—all cases of malarial infection would rapidly become pernicious. Though the theory of Metschnikoff is not held by all who have made a study of malaria, it is certain that the organisms are taken up by phagocytes—not only by certain of the circulating leucocytes, but by others, and very largely by cells in the splenic and hepatic capillaries, the bone-marrow, etc. In the latter organs, in fatal cases, we find large numbers of parasites, in various stages of development in the red-blood corpuscles, in the cells in question. It seems rational to look on this as simply an exaggeration of a physiological process. The investigations of Quincke show us that red-blood corpuscles which are about to end their existence easily fall a prey to the cells mentioned. Whether the still active and potent parasites are overcome by the phagocytes, or whether, having been weakened by chemical substances, they are taken up as so much foreign matter, at all events they disappear.

[1] *Act. u klin. Malaria-Studien*, Berlin, 1890.

If the removal is not complete, and a sufficient number grow and reach the reproductive period, the host will have another paroxysm, the severity of which, within certain limits, will be in proportion to the number of organisms. If none are left, there will be no paroxysm. If only a few remain, they may be disposed of before they have time to reproduce in sufficient numbers to set up anew the phenomena of ague. Yet even when all traces of the parasites have been lost for a time, they may still exist in a condition and in a part of the body we do not know, though we have reason to look on the spleen as the dépôt. We know from experience that at periods usually of one week, but sometimes much longer, these latent forms may again assume the active condition.

In the cessation of malarial paroxysms under the influence of drugs some act, we may suppose, simply by increasing the natural resistance of the body. In this way the so-called tonics and some drugs which strongly effect the nervous system may act, and as quinine has both these actions, being in small doses a tonic, in larger doses an excitant, it is not strange that its action has been explained in the same way. When we consider, however, the certainty and rapidity of its action, and remember that the disease formerly known as the *opprobrium medicorum* is through it the one most amenable to treatment, we are forced to abandon that explanation. We are therefore led to consider the theory of Binz, already mentioned—viz. that the drug acts directly on the cause of the disease.

If a drop of quinine solution be added to a drop of blood containing the plasmodium, the characteristic motions of the organisms cease, and the organisms themselves assume a cadaveric appearance (Laveran). It may be objected that in this method of experimentation the influence on the organisms is not a simple one, the blood being acted on by the solution chemically and mechanically. Experiments on the isolated organisms being out of the question, we cannot bring more direct demonstration. There is, however, a legitimate analogy close at hand.

Binz long ago showed that quinine has a marked influence on protoplasm. In his earliest experiments he showed that in a dilution of 1 : 20,000 it killed infusoria—paramecium—signs of paralysis appearing within five minutes after the organisms were exposed to the poison, and complete dissolution in two hours. A remarkable fact was brought out in these investigations; that is, that quinine was more active than such poisons as salicin, morphine, and strychnine. Quinine was also found to be poisonous to smaller monads, killing them as rapidly in dilutions of 1 : 60 as did corrosive sublimate in the strength of 1 : 180.[1]

The action of quinine on animal contractile protoplasm was demon-

[1] Binz, *Centrabl. f. d. med. Wiss.*, 1867, p. 305.

strated by many other investigators, and Darwin showed it to obtain with vegetable protoplasm in his beautiful experiments on *Drosera rotundifolia*.[1]

The nature of this action of quinine, or the mode in which it is brought about, is not so clear. Quinine deprives protoplasm of the power of absorbing oxygen, forming, according to Rossbach, a combination less easily oxidizable than either substance alone. Whatever be the true explanation, the fact remains that certain organisms are strongly and injuriously affected by quinine, even in small quantities; and although we cannot assume that the Plasmodium malariæ is identical in its vital characteristics with the organisms experimented on, we have no reason, on the other hand, for believing it to differ essentially in its reaction to such an agent as quinine.

A peculiarity of the problem of rendering the parasites harmless is that they exist, so far at least as the active forms are concerned, in the blood-vessels. As quinine circulates in the latter, the dilution in which it comes in contact with the organisms is not so high as would appear at first thought, and the task simpler than if the organisms were to be reached only through the juice-canals. The medium to be poisoned is not the whole body, but only the blood-mass.

Five grains of quinine, circulating in the blood of a man of average size, represents a dilution, in round numbers, of 1 : 16,000; which is stronger, it will be remembered, than that with which Binz paralyzed colpoda in five minutes.

The absorption of quinine takes place rapidly under ordinary circumstances. Kerner found it in the urine in fifteen minutes when given by the mouth to healthy men.[2] Baccelli[3] found that excretion began in twenty-four minutes when the drug was given by the mouth, but in fifteen minutes when injected under the skin or in a vein in patients with malarial fever. Carofolo,[4] using 0.25 gramme, found quinine in the urine in eleven minutes after giving it by enteroclyster, and after fifteen minutes by subcutaneous injection. Although excretion begins early, as shown by these experiments, it goes on slowly. Baccelli found traces up to twenty-two hours after intravenous injections of 1 gramme, and as late as thirty-two, or even forty-eight, hours when given hypodermically. These results, which agree with those of Binz and Kerner,[5] show that the time required for excretion is not much affected by the method of administration, and from Carofolo's experiments it seems that this time depends largely on the quantity given, one-fourth of a gramme being finally excreted in about six hours. Baccelli agrees with the statement of

[1] *Insectivorous Plants.*
[2] *Arch. für Physiologie*, 1870.
[3] *Berliner klin. Wochenschr.*, 1890, p. 489.
[4] *Il Morgagni*, Nov.–Dec., 1884, 735.
[5] *Real-Encyclopædie*, 2 Aufl. Bd. iv., art. "Chinarind."

Manassein, strengthened by the experiments of Welitschkowski,[1] that the existence of fever retards the excretion of quinine. We seem entitled to believe, from all these investigations, that a considerable proportion of quinine which is absorbed circulates for a comparatively long time with the blood.

From what has been said regarding the natural cure of malaria, it is clear, *a priori*, that a highly poisonous solution is not necessary to check the paroxysms of the disease. All that is required is a solution of sufficient strength to inhibit the growth of the organisms, when they will become the prey of the phagocytes. It has been shown by the careful observations of Plehn and Baccelli that in their various stages the parasites vary greatly in their resistance to quinine, and that the phase in which they are most sensitive is the amœboid one, which occurs, clinically, between the paroxysms. These observations I have confirmed in a large number of instances. They agree with a clinical fact to be mentioned later. If quinine be given in this period in a case of simple type, the development of the parasites will be checked and the individual, for the time being, cured. If the parasites are present in widely different stages, as occurs in cases of irregular or mixed type, another paroxysm will follow unless the effect of the drug be continued. A few organisms remaining after the action of the remedy has passed by will usually be disposed of by the natural defences. Yet if this is not complete the subject will run the risk of a recurrence at some later period. At present we know of no means by which we can destroy the latent germs, our best method, learned by common experience, being a sort of continuous sterilization.

The action of quinine in malaria we may accordingly explain on the ground that while the drug is peculiarly destructive to the organisms which cause the disease, quantities sufficient to act on the parasites may be taken by man without serious detriment. It is plain that both these qualities are relative, and it is equally plain that other substances may be found which combine them to a practicable extent, though up to this time none have been demonstrated to rival the cinchona alkaloids in efficacy. It is also clear that in large doses quinine exerts its beneficial effect only by a direct action on the causes of the disease, and does not strengthen the individual against future invasions, except in as far as it prevents the anæmia consequent on any attack.

Many writers have criticised the propriety of calling quinine a specific, most frequently on the ground that it neither prevents relapses nor protects against future infections. The difficulty seems to be a verbal one. So long as we know what quinine can do, and how to use it for producing the result, we may be quite indifferent to the application of words to that process. There is one criticism that at

[1] *Petersburger med. Wochenschr.*, 1877.

present cannot be explained away. That is, that sometimes paroxysms of ague occur in persons intoxicated with quinine. If these cases in future are carefully studied, it will probably be found that the paroxysm really begins before the quinine manifests itself. These cases must be studied, not by subjective symptoms, but by the thermometer and microscope.

The Salts of Quinine.—Of the various salts of quinine found in commerce, the sulphate is the one most used in this country. In Europe the hydrochlorate has the preference, which it seems to deserve on account of its higher alkaloidal strength (81.71 per cent.; sulphate, 74.31) and greater solubility (1 : 21.40; sulphate, 1 : 581). It is said, however, that these characteristics are variable, owing to differences in the quantity of water of crystallization. On the whole, the sulphate, always at hand, usually pure, and of low price, is fully deserving its wide use.

Many other salts have been made and proposed, usually on theoretical grounds. For ordinary antimalarial use they have no superiority over those mentioned. Some of them will be mentioned under other heads.

Dosage.—With the more exact study of malaria in the last ten years, the fact has been fully established that enormous doses of quinine are never necessary. When we consider that the drug is by no means an indifferent substance in the human organism, this is of great practical importance. When the result of administration can be controlled by microscopical examination of the blood, as in hospital use, minimal doses suffice. Otherwise, the same result may be approximately obtained by using the remedy in the manner which ensures its absorption at the best time, and by closely observing the effects.

In an ordinary case of intermittent fever 10 or 15 grains of quinine will almost always check the paroxysms. In more severe cases larger doses will be required. But even in the most severe cases a larger quantity than 40 grains in twenty-four hours will not often be needed. Laveran tells us that even in the most severe cases which he encountered in Algiers he never gave more than 45 grains of sulphate or muriate of quinine in a day, in ordinary cases finding 10 or 12 grains sufficient. This corresponds to the dosage recommended by Hertz[1] and most other recent writers, including those in tropical localities. Although very much larger doses are frequently used in the United States, I am convinced that they are unnecessary, often detrimental, and sometimes dangerous. That many cases are reported in which large doses have been given without bad results may be partly due to non-absorption of the drug. Thus, in severe cases in which

[1] *Ziemssen's Handbuch*, 3 Aufl. ii. Bd.

doses of 30 grains had been given by the stomach, Baccelli was unable to find traces in the urine within six hours.

This is evidently not the place to consider the toxicology of quinine. If the doses I have indicated, and the remarks on the mode of administration given below, are followed, accidents will seldom occur and never be serious. The number of people who have idiosyncrasies to quinine is much smaller than the laity imagine, and many of the effects attributed to the drug are really complications of the disease. Nevertheless, in prescribing quinine for the first time the patient should be questioned as to the existence of any particular susceptibility, and the effect of the first administration observed.

In the case of children the amount is regulated by the ordinary rules.

Adjuvants.—Many substances have been proposed as adjuvants to quinine or to lessen some of its unpleasant effects. The most important of these are piperine and capsicum, and ergot. Piperine has been used as an antiperiodic. It is no longer used in acute attacks, but is useful in chronic cases as a stomachic. The same may be said of capsicum. In Warburg's tincture, so highly praised by Maclean, the increased activity of the quinine seems due to the diaphoretics and aromatics.

Ergot appears to have been first put forward to relieve the symptoms of quinine intoxication by Schilling in 1883. It has been successfully used by a practitioner of large experience in my acquaintance, who combines the powder or extract with quinine in the proportion of one to two. Dilute hydrocyanic acid in large doses (10 minims repeated at intervals of fifteen to twenty minutes) and hydrobromic acid were formerly used for the same purpose. I do not think it advisable to mask the symptoms of mild quinine intoxication, and since I have confined myself to moderate doses have seen no kind of severe effects. (See below, under Idiosyncrasy.)

A very useful practice is that recommended by Kerner, of giving carbonated water during the administration of quinine. By this the absorption of the remedy is assisted and its antipyretic action increased.

Mode of Administration.—In ordinary cases quinine is most conveniently given by the mouth in solid form, and is usually efficient when so given. The practice of taking the powder, not uncommon in some places, has no advantage over less simple methods. Ready-made pills are so frequently undissolved that they should never be used. The compressed pills seem more reliable than the others, but that they cannot be depended on is shown by the experience of DaCosta, who found twenty unaltered pills in the dejections in one instance. Freshly-made, soft pills, gelatin capsules, or wafers offer the best method where a solution is not required. But whenever it is necessary or desirable to have as few obstacles to absorption as possible, or to be sure the

proper quantity is ingested, quinine must be given in solution. It should at all times be so given in the case of very young children, who cannot swallow pills, and in military and hospital practice.

It is unfortunate that this method of giving quinine is deprecated by many on account of the bitterness of the remedy. The taste of quinine, though bitter and lasting, has in it nothing nauseating. Many persons take it from the first without repugnance, and many more soon become accustomed to it. In the case of children, and those who resemble children in their dislike to bitter tastes, the latter can easily be removed by lemon-juice or by chewing a biscuit.

In making up solutions, dilute or aromatic sulphuric acid should be added in the proportion of a drop for each grain, and some such aromatic as peppermint-water be used as a vehicle. More elegant preparations can be made by using syrup of ginger or orange-peel, liquorice, or fluid extract or elixir of yerba santa.

Rectal Methods.—The rectum is often utilized for the administration of quinine, especially in children and others who cannot or will not swallow the drug.

In cases in which it is deemed necessary to give quinine during the febrile stage, or at other times when gastric irritability is so great that the stomach will not retain anything, the rectum is frequently tolerant and the remedy promptly absorbed. Before giving the enema the rectum should be washed out with tepid water, and the quinine, in the dose of from 10 to 30 grains, dissolved with the aid of an acid given in one to three ounces of starch-water, usually with the addition of opium. Unfortunately, tenesmus often comes on very rapidly, so that, part of the quinine being lost, the dosage is uncertain. In view of this, Carofolo[1] recommended high injections, and claimed that he had results almost as good as by the hypodermic method.

Suppositories of quinine have frequently been used. Pick[2] recommends them, especially in pædiatric practice. The suppositories are to be pushed some distance ("several centimetres") above the sphincter when the child is asleep. This method has the same disadvantage as that of rectal injection, and does not seem to be practised to a very great extent.

The Endermic Application.—The endermic method, formerly much used, has fallen into deserved neglect. An alcoholic solution of quinine can often be used with advantage for sponging the skin in children and feeble persons, in addition to other measures.

Insufflations of quinine, which have been practised by Jousset[3] and others, and recommended by Dujardin-Beaumetz,[4] do not seem destined to be much used.

[1] *Loc. cit.*
[2] *Deutsche med. Wochenschr.*, No. 18, 1884.
[3] *Gaz. méd. de Paris*, No. 27, 1874.
[4] *Leçons de Clin. thérap.*

The Hypodermic Method.—In the hypodermic method we have one of the most valuable aids in the treatment of malaria. In pernicious cases, even when the stomach appears to retain it, the remedy is seldom absorbed. In some cases, too, the patients are unconscious and unable to swallow. In these cases no time can be lost. The remedy must be introduced into the system as soon as possible. If we postpone this method until a large quantity of the drug has been given without effect by the mouth or rectum, absorption from these surfaces may come on later with very unpleasant results. It is a patent fact that the hypodermic method is not used to the extent it should be, no doubt largely from a fear of untoward results. Yet the risk of causing pain, abscess, or even gangrene, cannot weigh with the danger of the disease if left to itself or to an expectant or symptomatic treatment. Moreover, the risks to be feared, with the exception of pain, are not inherent in the method itself, but due to some fault in the technique.

In regard to the preparation to be used there is considerable choice. The muriate, here as elsewhere, recommends itself by its solubility and large proportion of alkaloid. It may be dissolved in distilled water, though with ordinary doses hydrochloric acid must be added to effect solution. As the bimuriate dissolves in 0.66 of its weight of water at the ordinary temperature, it is preferable to the basic salt. De Beurmann and Villejean[1] give the following formula for extempore preparation:

R. Quinin. hydrochlor., gr. xx;
Acid. hydrochlor. (sp. gr. 1.18), ♏v;
Aquæ dest., ♏xv.—M.

This solution is limpid, of the consistency of syrup. It becomes brown on keeping, without decomposing. One c.cm. (16 minims) of it corresponds to 50 c.g. (7.7 grains) of the neutral (bi-) muriate of quinine.

The addition of alcohol or of glycerin (Köbner) does not seem to be of great value.

Another preparation which may be used when it can be obtained is the hydrochlorate of quinine and urea, the *chininum bimuriaticum carbamidatum*, as prepared by Drygin and first used by Jaffé.[2] This is freely soluble, and in 55 per cent. solution, as recommended by Jaffé, contains about one-third of its weight of the quinine salt.

Many other salts have been devised for hypodermic use, but none of them possess any advantage over those mentioned. It is, however, by no means necessary to have one of these in order to practise this method. While these are not always accessible, and are comparatively costly, the sulphate can always be obtained. Having had considerable

[1] *Bull. gén. de thérap.*, cxiv. [2] *Cblb. f. d. med. Wiss.*, 1879, p. 422.

experience with this salt, and after using the others, I have every reason to recommend it for general use.

The solution I use is made in the strength of 10 grains to 1 fluidrachm, so that a hypodermic syringe will contain from 3.33 to 5 grains. A solution double this strength may be used in urgent cases. The capacity of the syringe should always be accurately known. The salt is mixed with distilled water, adding dilute sulphuric acid drop by drop until the whole is dissolved, and then adding water to make the required quantity.

In regard to the locality in which to inject, I have found the buttock, between the great trochanter and tuberosity of the ischium, the least sensitive, and the one in which, should there be a local reaction, least discomfort would be felt. I have never seen swelling or induration in that region. The lumbar region and the upper arm are both favorable places, but the calf is apparently more sensitive than any other part, even when the patients keep the bed.

The injection should always be made as deeply as possible, and on withdrawing the needle the small tumor formed by the fluid should be dispersed by gentle pressure. If more than one syringeful of the solution is needed, it is better to make two or three punctures in different places than to refill the barrel and repeat in the same place.

Quinine injections are always followed by pain, sometimes slight, at other times severe, and requiring the use of hot or cold applications to allay it. I have never found the pain severe enough to require the use of morphine, though I have used laudanum on hot compresses. In some cases slight induration follows, but soon subsides. The addition of carbolic acid has not seemed to lessen the pain or induration.

A large number of authors claim credit for making up solutions with tartaric acid. I made a series of experiments with this preparation; among others, with the assistance of Mr. W. Gammon, interne of the Sealy Hospital. The formula we used was:

℞.	Quininæ sulphatis,	ʒj;
	Acid. tartarici,	ʒss;
	Aquæ dest.,	fʒvj.—M.

We used this in men who were not seriously ill, giving two injections (5 grs. each) a day. It was invariably more painful than any other solution used, and in two cases we had such extensive swelling of the calf of the leg that it was feared abscesses would develop, though they did not.

The bisulphate of quinine is not soluble enough to be used without additional acid by the hypodermic method, so that it has no real advantage over the basic salt.

I have not mentioned heat as a solvent for quinine, as I do not look on it with favor. If it is relied on, instead of the acid the salt is apt to precipitate, making the dose uncertain and not diminishing the risk of abscess.

The dose of quinine for hypodermic use is usually stated to be one-third that by the mouth. I would not make the disproportion so great. In order to get an effect in severe cases I never give less than 10 grains at one time, and repeat it in an hour unless the temperature falls very rapidly. In mild cases, and in the non-malarial cases in which I tested various solutions, I could not see that the symptoms were more marked than when similar doses were given, in solution, by the mouth.

Intravenous Injections—Following the theoretical indication of bringing the medicament in direct contact with the blood and the parasites in it, Baccelli devised a method for the intravenous injection of quinine.[1] This method had been used by physiologists from the time of Magendie, but they used acid solutions, which Baccelli in his preliminary investigations found highly injurious. He accordingly devised the following solution, which, when warm, is perfectly clear:

℞. Quininæ hydrochlor.,	gr. xv;
Sodii chloridi,	gr. xiss;
Aquæ dest.,	f℥ijss.—M.

The sodium chloride is added to prevent the destructive effects of water on the red-blood corpuscles. The solution is boiled and filtered before using.

The method of injection is as follows: The veins of the forearm are distended by applying a bandage above the elbow. The needle is then introduced from below upward into a vein, a small one being chosen on account of the lessened risk of hæmorrhage. Usually a vein in the middle of the inner side of the forearm is selected. The syringe used contains 5 grammes (75 grains), and is fastened on the needle before inserting the latter into the vein. Strict antisepsis is practised. Before injecting, the bandage is removed and the fluid then slowly expelled, the operator at the same time looking out for the appearance of a small tumor, which indicates that the needle does not penetrate the vein. The small wound made is closed with collodion.

Symptoms of quinine intoxication, such as bitter taste, dizziness, fainting, small and frequent, afterward full and slow pulse, ringing in the ears, a feeling of constriction, and cool skin, soon come on, but usually disappear in from fifteen to twenty minutes.

As the result of carefully-conducted experiments Baccelli used doses of 1 gramme (15 grains), which gave brilliant results, not only in

[1] *Berlin. klin. Woch.*, 1890, p. 489.

regard to the harmlessness of the operation, but also in the infallible therapeutic results. Among the cases treated were several of pernicious fevers of various types. In no case did recurrence occur within a week. At times the temperature rose as much as one degree (Cent.), but soon fell spontaneously.

In a report on malaria to the second Italian Congress for Internal Medicine[1] Baccelli warned against the general use of intravenous injections, but declared the method to be the most energetic, certain, and rapid in the therapensis of pernicious malarial fever when the usual channels of absorption fail, provided care is taken to secure the proper technique and faultless asepsis. At the International Congress in Berlin[2] he reported on a total of 30 cases of pernicious fever treated by the intravenous method without a death, whereas out of 16 cases treated by the hypodermic method there were 5 deaths.

I have described this method at some length because it seems of great value. If physicians practising in the regions of the more severe malarial diseases would make themselves familiar with the method by experiments on animals, I have no doubt many lives would be saved.

THE PROPER TIME FOR THE ADMINISTRATION OF QUININE.—The time for the administration of quinine, as given by different authors, varies greatly. In the *Schedula Romana*, issued by the physicians of Pope Innocent X., in which the time and the proportions in which the bark was to be given were pointed out in express terms, the directions were to give it "at the beginning of the febrile chill." Administered in this way, its use was followed by a series of misfortunes, the weightiest being the failure to cure the Archduke Leopold of Austria. The counter-blast of the archduke's physician and the acrimonious literary warfare that followed it form one of the most interesting studies in the history of medicine.

The credit for making known to the profession an improvement in the manner of using bark is due to Sydenham, though both Talbot and Morton seem to have devised similar methods independently.[3] Sydenham gave the bark in the apyrexia. Bretonneau modified Sydenham's method by giving the drug in large doses as soon as possible after a paroxysm; and this method was followed by Elliotson, Graves, Briquet, Trousseau, Flint, Murchison, and many others. In fact, many have considered it dangerous to give quinine during the hot stage. On the other hand, some comparatively recent authorities advise that it be given during the time of pyrexia in remittent fevers. This diversity of opinion can only be explained by assuming that the latter idea has been formed from experience with cases in which the

[1] *Loc. cit.*

[2] *Wien. med. Blätter*, No. 42, 1890.

[3] See Sir George Baker, *Med. Trans.*, iii., Art. xiii.

temperature-range was not carefully followed, and that in the cases in which quinine was given during the pyrexia, and which were favorably influenced, the temperature was already falling. So irregular or erratic is the temperature-curve in many cases, and so deceptive the ordinary objective and all the subjective symptoms, that it is only by careful use of the thermometer that the real course of the fever can be made out.

In the experiments of Baccelli, referred to before, the author endeavored to find out the best time for the administration of quinine. His conclusions are as follows:

"1. Quinine, even in doses of 1 gramme (intravenous injections), is not capable of cutting short a febrile paroxysm when given in the beginning, or even three hours before.

"2. Given in the acme, it cannot accelerate the crisis.

"3. Given at the decline or at the end of the paroxysm, it either prevents the next or essentially reduces its intensity.

"4. In subcontinued fevers, which usually offer more resistance, it was found useful to give it as the temperature fell, as the subcontinued usually passed into the intermittent type, with decreasing paroxysms and frequently with rapid crisis."

I have frequently confirmed these statements with quinine given by the mouth or hypodermically in cases carefully observed. The manner in which they confirm certain facts noticed in regard to the parasites, and also the results of extensive and careful clinical experience, is very striking.

Formerly it was sometimes advised that quinine be exhibited at certain periods having reference to the expected chill. This is irrational, because even in cases in which the type is known the chill has no fixed place in the febrile paroxysm, occurring sometimes in the beginning, with the temperature normal; at others near the acme or at a variable time between the two extremes. Besides, in the remittent fevers, in which it is most important to time the administration properly, chills are frequently absent. The time in severe cases should be determined by frequent and careful thermometric measurements. In cases of ordinary intermittent fever the sweating stage is a sufficient guide.

There are still a few writers who advise the withholding of quinine until a few paroxysms have passed, "in order to fix the type of the disease." As this is a matter of no interest to the patient, and not necessary for successful treatment, and as every paroxysm does actual injury, the specific cure should be begun as soon as possible after the diagnosis is certain.

In applying the principles governing the administration of quinine to practice we have a certain amount of license. The best results are

probably obtained in ordinary cases by giving from 15 to 20 grains when the temperature begins to fall, though results equally good may be secured by giving two 10-grain doses, two, three, or even six, hours apart during the decline, or by giving three or four 5-grain doses at intervals of two hours in the same time. It is not advisable to give doses of less than 5 grains unless the intervals are very short.

With patients who are able to get up at once after a paroxysm—that is, as a rule, in intermittents of ordinary severity—the administration may be adapted to suit the convenience of the patient. Thus, if the paroxysm takes place early in the day, so that the temperature begins to fall in the afternoon, the full dose may be taken that day. If the attack comes later, one dose may be taken in the decline, the next in the following morning. If the paroxysm comes late in the afternoon or evening, it will be proper to take the full dose, on an empty stomach, next morning.

If the next paroxysm is missed altogether, the quinine may be withheld. If, however, there is a rise of temperature of more than one degree, 10 grains should be given, when the temperature will fall to normal or below. After this no quinine need be given until the seventh day after the last paroxysm. Although it can be taken with safety for long periods, there is no advantage in it, and as the continued use is often followed by disagreeable nervous symptoms, it should not be practised.

To simplify the foregoing statements, the following scheme may be laid down for the routine treatment of simple cases. It may be altered to suit all other varieties:

First day, in the decline, 20 grains of quinine.
Second day, if necessary, 10 grains.
Third, fourth, fifth, and sixth days, no quinine.
Seventh day, 20 grains.
Eighth to fourteenth days, no quinine.
Fifteenth day, 20 grains.
Sixteenth to twenty-first days, no quinine.
Twenty-second day, 20 grains.

If fever of more than two degrees occurs during this period, a full dose should be given, and the treatment, or at least observation of the patient, prolonged.

Contraindications and Idiosyncrasy.—In a case of malarial fever of more than the mildest degree, when the subject of it cannot leave the infected locality for a healthy one, there is no absolute contraindication to the use of quinine. It must be given, and unpleasant and dangerous effects guarded against by a careful selection of the mode of administration and dose.

In persons known to have a susceptibility on the part of the nervous

system, delirium can be guarded against by giving quinine in small doses at short intervals, and stopping as soon as the first symptoms of intoxication appear. In such cases bromides are very useful. I prefer bromide of potassium or sodium to hydrobromic acid or hydrobromate of quinine, as the dose of each agent can be more readily controlled than when given combined. The bromide should be given in full doses—40 to 60 grains—so as to produce an effect rapidly.

In middle-ear disease it is said that very small doses of quinine are efficient. In one such case that I saw the paroxysms ceased after taking 4½ grains—all the patient could bear. The infection had lasted for some time in the spring, but the blood-examination showed it to be rather mild.

It is hardly necessary to remark that pregnancy does not contraindicate the exhibition of quinine. If quinine ever does produce abortion, as is still asserted by some, it must be only in those women who have a predisposition to that accident. In such cases malarial diseases alone are more prone to cause abortion than is quinine. The harmlessness of quinine, as a rule, in pregnant women is very plainly shown in a valuable paper by Dr. M. Howard Fussell.[1]

Of the many forms in which idiosyncrasy toward quinine expresses itself it is unnecessary to speak in detail. Those caused by small doses, though often unpleasant, and, until recognized, alarming, are never dangerous, while those caused by large doses belong to the domain of toxicology rather than therapeutics.

In this connection the remarks of Von Graefe in reporting his first cases of quinine amaurosis are interesting and instructive. He said:[2] "That large doses of quinine paralyze the optic nerve will not prevent a rational physician from prescribing the remedy where it is indicated. For such a purpose I certainly would not have written these histories. Even if analogous cases are reported, as may happen now that attention is called to the subject, these, in proportion to the number of people who rejoice in the curative effects of quinine, would appear entirely isolated."

Other Cinchona Alkaloids and Substitutes for Quinine.—In the foregoing pages I have used the word "quinine" as a convenient one to represent the active principle of cinchona, and because it is the alkaloid most frequently used. Now that the price of quinine is inconsiderable, the strongest argument in favor of the other alkaloids no longer holds. Of these others, cinchonidine is the next in reliability to quinine, and can be used in some cases in which quinine seems to be unreliable.

Chinoidine has been used extensively, but seems to have no advan-

[1] *University Medical Mag.*, Oct., 1889.

[2] *Arch. f. Ophthal.*, 1857, iii. Abth. ii. p. 396.

tage except that of cheapness. Its chemical composition is not constant; the claim that it does not disturb the stomach, as might have been expected, was not realized; and Husemann's case[1] shows that it is not without danger.

Of the innumerable substances recommended for the cure of malaria, from arsenic to pambotano,[2] none have exhibited all those qualities which make quinine so valuable. Arsenic is now seldom used in acute malaria. To check the paroxysms it must be given in large doses (from $\frac{1}{2}$ grain to $1\frac{1}{2}$ grains daily), and even then is uncertain and of course dangerous. Nevertheless, it occupies an important position in the treatment of malarial anæmia, under which head it will be considered later. Eucalyptol, resorcin, and iodine, the best among the recently recommended substitutes, have not given encouraging results in my hands. Nor can I agree with the advice often given to fall back on one of these when quinine fails. In such cases it is better to scrutinize the method of administration, the diagnosis, and the condition of the patient than to resort to the latest "ague-cure."

The statement so often made in reports on quinine substitutes, that in a large proportion of the cases experimented with quinine had failed, usually gives evidence that the reporter either made a mistake in the diagnosis or did not understand quinine.[3]

In order to make any showing to compare with that of quinine, all claims regarding its substitutes should state—1. That all the cases treated were malarial, as shown by the blood-examination; 2. The type; 3. As nearly as possible the severity, with some indication of the duration.

An experience of my own illustrates the usual result with substitutes for quinine. Nitrate of potash, mentioned by Eichhorst as a remedy for malaria, was reported to be infallible by Sawyer of St. Louis and Hunter of New Orleans,[4] and in a few experiments with vernal intermittents I also was successful. In more severe intermittents and in remittents, however, it failed entirely. In repeating the experiments on mild cases I was again successful, but in the course of the observations I learned, by a mistake in dispensing, that nitrate of sodium was

[1] *Pharm. Zeitg.*, Dec. 16, 1885, p. 967.

[2] For a résumé of the scanty literature regarding this drug see article by Dr. A. E. Roussell, *Phila. Med. and Surg. Rep.*, July 25, 1891, p. 129.

[3] In an enthusiastic report on sunflower as an antiperiodic, based on an experience of *two cases*, both these errors appear. Thus in one case, in which an intermittent appeared in the convalescence of measles in a child of five years, quinine was given to the amount of 6 to 10 grammes daily! The reporter naïvely adds that the temperature rose one degree on the second day, notwithstanding the quinine.—*Arch. f. Kinderh.*, xii. 236.

[4] *Virginia Med. Monthly*, Feb., 1890.

equally potent. Still later, in cases apparently no more severe, it failed entirely.

Before closing this section a word may be said on "tasteless quinine." This is either tannate of quinine or the alkaloid itself. The former is usually employed for making "quinine chocolates," and in prescribing them it should be remembered that the tannate contains only 22.60 per cent. of alkaloid. The alkaloid is sometimes sold mixed with sugar. Its taste is very faint (though it is very readily brought out by acids), and it usually cinchonizes very promptly in sufficient doses. Owing to the difference in density of sugar and quinine, the proportions in the mixture sold are variable.

The Preventive Treatment of Malaria.

Our knowledge of the malarial parasites has thus far not added scientific accuracy to the study of prophylaxis. We do not know where or in what form the pathogenic organisms exist outside of the body, nor have we exact ideas as to their mode of entrance. With other infectious diseases the tendency is to give more prominence to the alimentary canal as the point of entrance of pathogenic organisms, but as regards malaria most authorities look on the respiratory passages as principally or exclusively concerned. Such authorities as Tommasi-Crudeli, Celli, Kelsch and Kiener, and Hirsch consider air as the great medium of infection, whilst Laveran, on the other hand, gives some strong arguments throwing suspicion on potable water. There can be no doubt that both sides are right, but that the relative frequency of each mode of infection varies in different localities. Pending the acquisition of more exact knowledge, we have to rely on the facts brought out as the result of long experience.

Considering the actual loss of time and labor caused by the prevalence of malaria in a country, it would seem as if ordinary principles of economy would lead to the adoption of means for its extermination or limitation at any cost. How little this is attempted is only too evident. Of course in the opening up of a new country to cultivation, in building railroads and canals, especially in tropical countries, such work is out of the question; but there are many districts comparatively old and well settled in which improvements could and should be made. The remains of the extensive works built by the ancient Romans to drain the Campagna, discovered by Father Secchi and Dr. Tucci,[1] show that those people did not trust to cultivation alone to render healthy that once fertile territory. And even if we cannot make every locality absolutely free from malaria, it is evident that a judicious disposition of the soil will always lead to great improvement.

Marsh-lands should either be drained or, by the formation of

[1] Tommasi-Crudeli, *Die Malaria in Rom*, translated by Schuster, Munich, 1882.

ponds or lakes, so treated that overflows, with subsequent drying, be reduced to a minimum. Sometimes the planting of trees is beneficial; at other times it is better to cut down forests and cover the ground with turf. All such works should be done at the times of least prevalence of malaria. It is now generally believed that the eucalyptus, of which so much was hoped, has no peculiar action on malaria. Nor is its rapidity of growth as extraordinary as was alleged. In Italy it was found that the trees were very sensitive to cold and the stems easily broken by the winds. In the Southern United States the trees failed, not only on account of the occasional frosts, but even in places where frosts did not occur, because their small roots did not enable them to withstand the winds common in that part of the country. For that reason the planting of native trees seems more rational. It is probable that the sunflower, as proposed by Maury and used recently in Cuba,[1] could be employed with advantage in drying certain marsh-lands.

Individual prophylaxis will always be a matter of principal importance. When personal reasons make residence in a malarial locality necessary, the mode of life must be so ordered as to reduce to the smallest the chances of infection. Emigration should be so timed that arrival takes place in the least dangerous season.

The house should be, if possible, on a well-drained hill, to windward of swamps or marshes. In warm countries it should be elevated some distance, and the ground under it dry, well drained, and in free communication with light and air. It is best to have an impermeable floor of cement or asphalt under the house.

The mode of life should be so arranged that the individual is exposed neither to the midday sun nor to the exhalations of morning and evening. Fatigue, hunger, and excesses of all kinds, from their known effect in lessening the resistance to infection, must be avoided as much as possible.

Exposure to swamps or deep and unventilated spots, especially after wet weather and at nightfall, sleeping in the open air, bathing in streams in the morning and evening, are all dangerous. On expeditions the camp should not be made on the banks of streams. In exploring malarial shores the vessel will be the safest place at night. Canalis has shown how the examination of the blood may be utilized in prophylaxis.[2] Men who are to be exposed to unusual risks are to be examined on the eve of expeditions, and if organisms are found put on treatment. This will obviate the discomfort of having a chill away from camp and prevent embarrassment to the expedition. The daily use of the thermometer can also be of great service in prophylaxis. A rise of one or more degrees, not enough to be felt, can usually be

[1] *Arch. f. Kinderheil.*, xii. 1890–91, p. 236.
[2] *Arch. Ital. de Biol.*, t. xiii. fasc. ii.

noted a few days before a paroxysm. Operations like cleaning ditches and canals should not be made in the malarial season.

In regard to clothing no rules can be laid down. It should be so chosen as to permit least risk of chilling the surface.

The bed-room should be dry and well aired. The advice sometimes given, to close the windows at night, is based on a misconception. Impossible in warm weather, it has at no time any advantage, since the aspiration of a room so closed is so great as to bring in currents quite as dangerous as those which enter through larger openings.

The beneficial effects of mosquito curtains in keeping off malaria have been affirmed by Emin Pasha.[1] In many malarial countries they are used as a matter of necessity, and probably act by breaking the force of the air-currents which carry the germs.

In warm climates nothing so rapidly reduces the bodily vigor as an abridgment of the sleeping-time. It should always be avoided in malarial localities.

Food should be so selected as to be nutritious and digestible. Alcoholics, especially the lighter wines, beer, ale, etc., are not contraindicated in those who are accustomed to them, but are by no means necessary. Coffee and tea are not only useful as tonics, but have the advantage of being sterilized fluids. Drinking-water should always be boiled in malarial localities, and as a rule taken only at meal-time.

Exercise, cheerful company, and variety of occupation are all useful for those exposed to malaria, and a sanguine disposition is probably one of the best safeguards against the disease.

The medical prophylaxis must begin with any slight ailment or any abnormality in the digestive and assimilative functions.

Anæmia especially must be the object of scrupulous solicitude, and be avoided or removed by careful attention to diet and mode of life, with such remedies as may be indicated. Very often this originates, in warm countries, in new-comers, in constipation, due probably to increased perspiration and neglect of exercise. Following this there is diarrhœa, the patient having two or three soft stools every morning. This may last for years, the individual never having formed stools, and, though often appearing well nourished, is more or less anæmic. Bismuth in full doses or a pill of acetate of lead and tannic acid leads to prompt improvement.

In regard to the prophylactic action of quinine, we are as yet without data for forming rules with any pretension to accuracy. While it would be easy to bring forward many isolated instances of protection by quinine, and many examples of its efficacy when used on large bodies of men, there are many who assert that the drug is useless or even dangerous. In endeavoring to reconcile the discordant results of

[1] Stanley, *In Darkest Africa*, ii. 31.

different observers, it is impossible to compare them, from the fact that in some cases small doses, in others large ones, were used; in some cases given daily, in others at short intervals.

The most reasonable view of the subject is that summed up in the *Medical and Surgical History of the War of the Rebellion*, 3d med. vol., p. 171, as follows: "The experience of the war appears to teach that when a command is to be temporarily exposed in a specially dangerous locality, quinine should be used for the sake of such protection as it may give. But when a command is to be stationed for a long time in a malarial section, prevention should be attempted by a judicious selection of the camp-site and avoidance of predisposing causes, while quinine is reserved for the first manifestation of the malarial poison and for specific prophylaxis under conditions of unwonted exposure or anticipation of relapses."

But even when given for the specific purpose mentioned above, the best way to use the drug is not yet agreed upon. It is, however, a subject of such importance that it should be experimentally worked out by giving it in different ways to large bodies of men under identical conditions.

In the mean time, I would advise a method which has good theoretical grounds, and in the hands of Plehn has demonstrated its practical value.[1] Plehn gave one gramme of sulphate of quinine in one dose at intervals of seven days. The experiment was made in some of the most notoriously malarial ports in Batavia on a ship's crew of seventy men, and with perfect results. In making this experiment Plehn was guided by the thought that the virus of malaria requires at least seven days for its development in the body, and that one large dose of quinine in that period would be sufficient to hinder the development of the organisms. Plehn himself does not look on one experiment as conclusive. Both time and dose may be varied.

Arsenic is still used as a prophylactic, and, at least for long-continued use, is to be preferred to quinine. It should be given in daily doses of $\frac{1}{30}$–$\frac{1}{6}$ of a grain of arsenious acid or 4 to 20 minims of Fowler's solution, after meals. It should not be continued for more than two or three weeks at a time, and it must be stopped at once on the appearance of symptoms of gastric irritation.

In view of the results of Tommasi-Crudeli[2] and Huber,[3] decoction of lemon seems to deserve further trial. One lemon is cut in slices, with the skin, three glasses of water added, and boiled to one glass and taken fasting.

In concluding this subject it may not be superfluous to add that

[1] *Berlin. klin. Wochenschr.*, 1887, p. 733.
[2] *Med. Times and Gaz.*, Sept. 6, 1884.
[3] *Philada. Med. and Surg. Rep.*, Jan. 28, 1888.

there is no characteristic or combination of characteristics by which we can recognize a given locality to be malarial, except from the result of exposure. And in malarial regions, owing to the exigencies of practical life, every one will sooner or later exhibit some form of malarial infection. The treatment of these affections must therefore be our next consideration.

Intermittent Malarial Fever.

The treatment of a paroxysm of malarial fever is a matter seldom brought to the attention of a physician. The experienced sufferer lies down until the "fit" has passed, and then takes his quinine according to some rule, and it is only when the disease offers unusual resistance that he seeks assistance. Yet much can be done during the paroxysm, not only in lessening discomfort, but also in diminishing injury.

The first duty of the physician in taking charge of a case of intermittent fever is to ascertain whether it is malarial or not. No matter how clear the history of exposure, how typical the course of symptoms, and how characteristic the appearance of the patient, a close examination should be made, and no specific treatment begun until the diagnosis is certain. It is an every-day experience to see the victims of tuberculosis treating themselves (and sometimes being treated) for malaria. I have seen two cases of mycotic endocarditis treated for long periods on the supposition they were malarial. Less frequently, one of the following diseases may be the cause of error: typhoid fever, relapsing fever, pyæmia, pent-up pus, lymphadenoma, syphilitic fever, urinary fever, morphinism (Murchison[1]), jaundice from obstruction (Ord[2]), gastro-duodenitis, pulmonary catarrh, pent-up serum, forming pus (Musser[3]), gall-stones (Charcot[4]), uterine hæmatocele, and hysteria (DaCosta[5]). With some of these the differential diagnosis is easy. In others the presence of enlarged spleen will make it difficult. In all cases the blood-examination will be decisive.

At the onset of the first symptoms, well known to all who have had malaria, such as pain in the back and extremities, yawning, and the like, the patient should go to bed. No food or drink should be taken, as it will only increase the discomfort of the vomiting which is an almost constant symptom. During the chill the patient should be covered, though an excess of bed-clothing is neither essential nor pleasant. Rubbing the skin, and hot-water bags to the back and extremities, are often very grateful, and in debilitated patients necessary.

[1] *Lancet*, May 3, 1879.
[2] *St. Thos. Hosp. Rep.*, xii. 1881.
[3] *N. Y. Med. Journ.*, 1884, i. 619.
[4] *Leçons sur les Maladies du Foie.*
[5] *Med. Age*, 1890, viii. 529.

See also the Middleton-Goldsmith Lecture of Dr. Wm. Pepper (*Med. News*, March 29, 1890), and Dr. W. Osler on "Fever of Hepatic Origin" (*Johns Hopkins Hosp. Reports*, vol. ii. fasc. i.).

When vomiting occurs, the stomach should be emptied by a draught of tepid water, and if it continues it should be checked by cold carbonated water in small quantities; by counter-irritation over the stomach, either by sinapisms or a towel wet with chloroform; or if severe by a hypodermic injection of morphine.

If the patient is seen early enough, an effort may be made to abort the chill by injecting a full dose of morphine, which, even if not perfectly successful, will lessen the discomfort of the patient.

If symptoms of collapse come on—and they should be anticipated in old or cachectic persons and young children—stimulants must be resorted to. Formerly, brandy, Hoffman's anodyne, aromatic spirit of ammonia, and hot coffee were used, and were certainly beneficial. A hypodermic injection of atropine, $\frac{1}{60}$ to $\frac{1}{30}$ of a grain, will, however, be at once more effective and less disagreeable. At the same time, frictions and stimulating enemata may be used, and if necessary hypodermic injections of ether.

If the cold stage be unduly prolonged, the possibility of the case being one of unusual severity must be borne in mind, and especially so in countries where pernicious forms occur. The prolongation of the cold stage may be due to the presence of undigested food in the stomach. If so, an emetic should be given, preferably one that is not depressing, as warm salt water or herb tea, rather than ipecac.

As the hot stage comes on the patient's covering should be made lighter. The pressing requests for cold water must be refused and thirst relieved by crushed ice.

For the throbbing headache cold compresses may be used and morphine may be given. In my observations on the natural history of malaria, I usually gave as a placebo a combination of morphine and spirit of mindererus, as recommended by Professor Bemus.[1] The mixture used was—

℞. Morphinæ acetatis,	gr. ss–j;
Liquor. ammonii acetatis,	f℥vj.—M.

Of this a table-spoonful was given every hour from the beginning of the fever, and it was very evident that all stages of the disease were passed through with less discomfort than in cases not so treated.

Aconite, recommended by DaCosta[2] for the headache, I have not used. Antipyrine and antifebrin I have found useless in both large and small doses.

Pain in the epigastrium or in the region of the liver and spleen is usually and properly referred to congestion of the respective organs. It is best treated by the application of large mustard plasters.

[1] *Pepper's System*, vol. i. p. 595.

[2] *Loc. cit.*

In the sweating stage, as a rule, no pressing symptoms arise. Water may be permitted. If full apyrexia comes on, the patient may change his clothing and go about. If the sweating be excessive, it should be checked by rubbing the surface with hot cloths.

It is in this stage that specific treatment is to be instituted, according to the principles already described. The probable result of this can, to a certain extent, be predicted from the condition of the patient after the paroxysm. If the subjective symptoms are such that the patient voluntarily leaves the bed, expresses himself as well, and the temperature falls rapidly, it is almost certain that no paroxysms will follow the administration of quinine. If, on the contrary, there is a feeling of enervation with headache, nausea, or anorexia, even if the temperature falls to the normal, the possibilities are that another paroxysm will ensue. A recognition of this fact, and the use of the thermometer (if possible, also the use of the microscope), are of great assistance in prognosis and treatment.

Formerly it was supposed that in order to get the proper effect of quinine it had to be preceded by a purgative. This is no longer held, though in very many cases purgatives are indicated by the existence of constipation, coated tongue, and muddy skin, and in this condition calomel is the remedy universally used. It is most frequently given in small, repeated doses, combined with bicarbonate of sodium and, if desired, an aromatic, as the aromatic powder of the Pharmacopœia. If a stronger action be desired, calomel can be given in combination with compound extract of colocynth and an aromatic oil or extract of belladonna. In all cases it should be followed by a saline, such as Rochelle salt or cream of tartar. In cases where it is considered necessary to get a purgative and a specific action at the earliest moment, the calomel and quinine can be given together in pills or capsules. In debilitated persons or those recently suffering from intestinal disease purgation must be practised with caution.

It cannot be repeated too often that in frank cases of malaria there is no contraindication for quinine, and those who wander from symptom to symptom, "getting the patient in condition for quinine," will have disagreeable failures. In cases of short duration, or where the type of the disease is still pure, the treatment laid down will usually be promptly successful. Frequently the task is more difficult. From neglecting specific treatment, or from taking quinine in insufficient doses or at improper times, or from repeated fresh infections, the paroxysms become irregular and the different stages often variable. Besides this, the stomach and intestines are often more or less deranged. In such cases the patients should be put to bed and the temperature taken at short intervals. The bowels should be moved by a mild purgative, and symptoms of irritation of the stomach allayed by appro-

priate treatment. The food must be given in small quantities, the best being milk, with carbonated water or lime-water. Very often a marked improvement follows this preliminary treatment, and as soon as this is evident the specific treatment should be begun, giving the remedy in the way that is least obnoxious to the alimentary canal. Such cases often pass insensibly into the remittent or chronic forms of malaria, unless promptly treated.

To return to the uncomplicated cases. On the day of the expected paroxysm the patient should remain indoors, take easily digestible food in small quantities, and have the temperature taken at intervals. If there is no marked rise, no quinine need be taken until the next period, as described above. If, however, the temperature reaches 100° F. or more, 10–20 grains of quinine should again be taken in the decline, when the attack will almost certainly be broken.

After this the next indication is to restore the patient's strength and promote blood-formation as rapidly as possible. The diet should be generous, and wine may be taken at meal-time. Baths form an important part of the roborant treatment, and exercise is equally valuable. The bowels should be regulated by appropriate treatment. Tonics are always indicated, and among them the cinchona preparations are the best. The compound tincture of cinchona or the similar elixir of calisaya may be given in doses of from 1 to 4 drachms. Very often it is useful to combine a mineral acid with quinine. A preparation which I have used a great deal with satisfactory results is the following:

℞. Quininæ sulphat., gr. xxiv–xlviij;
Acid. hydrochlor. dil., f℥vj–f℥j;
Extract. taraxaci fluid., f℥iij;
Elix. calisayæ, q. s. ad f℥vj.—M.
Sig. A dessert-spoonful after meals in a wine-glassful of water.

Whether taraxacum is an hepatic stimulant or not, it seems to be a useful adjuvant in the treatment of cases in which there is the condition commonly known as torpidity of the liver.

In all cases which have had more than a few paroxysms iron and arsenic must be added to the treatment. Fowler's solution, in increasing doses, and Basham's mixture, are very good forms in which to give these remedies.

This treatment should be kept up until the health of the patient is fully restored, giving quinine at the appropriate intervals to prevent relapses. The condition of the spleen is a useful indication of the complete cure.

The ordinary complications of intermittent fever usually disappear

as rapidly as the primary disease under the influence of quinine. If not, they should be subjected to appropriate treatment as independent diseases.

Remittent and Atypical Malarial Fevers.

The accurate discrimination of this class of fevers is one of the most valuable results of modern clinical investigation. This would have been less important, except for the fact that recognition of their real nature makes possible a rapid return to health, by means of specific treatment, of a large proportion of such cases, instead of leaving them to the *vis medicatrix naturæ* or to the methods followed in other febrile diseases. Formerly the recognition of malarial remittent fever was a matter of individual diagnostic insight, tempered very much by the environment of the physician. Now we have, in the microscopical examination of the blood, one of the most objective methods in diagnosis. If in a given case this cannot be practised, the "therapeutic test" must be tried, during which time the probability of the case not being malarial must not be lost sight of. This is especially important where the existence of typhoid fever is even a remote possibility.

The treatment of simple remittent malarial fever does not differ essentially from that of the intermittent variety. Quinine is to be administered in the first remission, and while waiting for this the most important symptoms may be investigated. If the patient be seen for the first time in what appears to be a remission, no time need be lost in waiting for another one, but a full hypodermic dose of quinine should be given at once. Here, as well as in the milder cases, morphine may be used with happy effects, and may advantageously be combined with atropine.

Vomiting is usually severe, and is often bilious, as indicated by one of the old names for the disease. Constipation is usually present also, and both these symptoms can be treated with advantage by calomel and ipecac in small repeated doses. If vomiting persists after the purgative action is manifest, efforts should be made to restrain it, as previously described. During this time nothing else should be given by the mouth, but food and other remedies given by enema.

Headache, delirium, or convulsions are to be met by the use of morphine, bromides *per enema*, or revulsives.

For hastening the remission, Maclean[1] used aconite, giving one drop of the tincture every ten minutes for an hour, and then every half hour until the temperature began to fall and the skin to act.

As soon as this takes place quinine is to be given. It should never be administered in solid form in such cases. If it is considered certain

[1] *Diseases of Tropical Climates*, London, 1886.

that the stomach is tolerant, it can be given by the mouth, with carbonated water after it. Ten grains should be given at once, followed in an hour by a similar amount, and repeated once or twice if a perceptible impression is not made on the temperature. If, however, the stomach does not retain the remedy, or if it does not seem to be absorbed, no time should be lost, but from 10 to 15 grains should be injected hypodermically, and repeated in one or two hours. In some cases the temperature will fall to a lower point than in the preceding remission, and in a few to the normal. In others little or no impression will be made. The effect of the quinine must be kept up, the patient taking from 20 to 40 grains daily. In very few cases will the fever last beyond the third day, and the fevers lasting more than four days under this treatment are very rare. With the reduction of the fever the cases are practically cured, though they run the same risks and must be treated after the same lines as cases of intermittent fever.

The existence of high temperature by no means contraindicates the exhibition of quinine, though cinchonism increases very much the discomfort of the hot stage if they occur together. The reason for giving quinine in the remission—or, what amounts to the same thing, in the decline—is that experience shows that only when so given does it manifest an evident action on the disease. As the remission is so slight as to escape even experienced observers, the thermometer must always be used to determine the "precious time for treatment," as Maclean calls it.

During the active specific treatment the strength of the patient must be kept up by the use of stimulants and suitable food, best given *per rectum*. In regard to stimulants and analeptics the statements made in connection with intermittent fever hold good. The many and various complications and accidental symptoms of remittent fever are to be treated on general principles. Most of them yield to quinine, so that it is unnecessary to complicate the treatment by giving them special attention during the febrile stage.

Typho-malarial Fever.

This is, in practice, either typhoid fever combined with a malarial infection, or, less properly, remittent malarial fever become adynamic. In the former cases the malarial element is to be treated on the lines already laid down.

Cases have been described in which it was supposed that malarial remittents had assumed a typhoid state. I cannot believe this possible, unless under extraordinary conditions of want of treatment and privation of food. Those investigators who have studied the Plasmodium malariæ in cases of this so called typho-malarial fever—and some of them have had large numbers of severe cases—are unanimous

in asserting they have never seen a case in which quinine failed to produce a good result. (This statement of course does not apply to pernicious cases, which die notwithstanding quinine. In these there is no question of confusion with any continued fever.)

Pernicious Malarial Fever.

Under this heading we can group all the acute cases of malarial infection which appear to threaten life. A large number of names have been given to these types, depending on clinical peculiarities or particular localizations of serious symptoms, but the disease is always the same, and there is but one remedy—quinine.

At times the disease may be suspected by certain peculiarities in the early paroxysms, such as Drake's "coldness in the great toe." Hilarity is not unusual in malarial paroxysms, and is sometimes exaggerated in pernicious cases. But too often the pernicious attack will come without warning.

If, as frequently happens, the physician first sees the patient in a condition of evident danger, cinchonization must be resorted to at once. Here remissions and exacerbations follow in rapid succession, and, no matter when given, quinine is likely to do some good. The vague chance that it may act injuriously as a depressant or otherwise does not come into consideration. It should be given hypodermically or injected into a vein, in the doses already stated.

A full dose of morphine and atropine should be given at the same time, and then the symptomatic treatment be carried out. The important indications next to cinchonization are to keep up the strength of the heart and the general nutrition. Whiskey and brandy hold a prominent place in this treatment, but cannot be relied on alone. They should never be given by the mouth, but, combined with beef-tea, milk, tea or coffee, be injected into the rectum in small quantities at short intervals.

As cardiac stimulants in pernicious malarial fever strychnine, nitroglycerin, and ether are to be used. They must be given hypodermically, in such doses as to make and sustain a distinct impression on the pulse. Strychnine is looked on as a *sine qua non* in the treatment of the severe malarial fevers by the physicians of the South-West, and I have seen many evidences of its value, alone or combined with nitroglycerin. It should be given in doses of from $\frac{1}{30}$ to $\frac{1}{20}$ of a grain, and may be repeated at intervals of a half hour to two hours if necessary. Many physicians look on strychnine as prone to cause abscesses. I take this to be quite as unlikely as in the case of quinine. The injections are, however, painful, and in one case, where a great many were made, I saw a stubborn œdema remain for some time after recovery.

Baccelli and many Italian and German clinicians recommend injections of ether, to the amount of from 1 to 2½ drachms in twenty-four hours.

In cases with coma, if it has not already been done, calomel should be given, and may be placed on the tongue in one large or several small doses. At the same time stimulating enemata and derivatives to the skin should be used.

In the algid condition a reaction can be most rapidly brought about by rubbing the spine and extremities, or even the whole body, with ice, or, if this cannot be had, by cold douches, followed by friction.

Delirium calls for the administration of morphine hypodermically, bromide and chloral in full doses by enema, cold to the head, and counter-irritation to the extremities. In case there is evidence of congestion, such as injected conjunctivæ and throbbing temporals, blood may be drawn from the temple.

Choleriform symptoms require morphine, with astringents and stimulants. Cold affusions and enemata have been recommended.

Vomiting is to be treated by the methods already described.

Excessive sweating is a symptom of the gravest prognostic import, and, persisting after the treatment already directed, including injections of atropine, usually indicates a fatal termination.

Hiccough, resisting the antispasmodics already mentioned, sometimes ceases under the administration of Hoffman's anodyne in full doses. Coming on late in the disease, it is a very unfavorable symptom.

The dyspnœa sometimes so alarming a symptom in cases of pernicious fever is generally said to be due to congestion of the lungs, and counter-irritants are advised. In some cases, however, it is due simply to the intense and suddenly-developed anæmia. The inhalation of oxygen might be tried in these with benefit.

Hæmorrhage from the mucous membranes or the kidneys indicates the use of ice locally, astringents, ergotin, and the like.

Arrest of the urinary secretion in these cases is usually combined with hæmorrhages and local congestions in the kidney, if we can rely on the conditions found *post-mortem* in fatal cases with this symptom. This complication is rationally treated by hydragogue cathartics, bitartrate of potassium having a peculiarly happy effect, according to some authors.

In pernicious fever the temperature is not always a guide to the progress of the paroxysm, as in the other forms, and the return of a period of safety must be recognized by a cessation of symptoms and the general condition of the patient. Every period of apparent improvement must be seized for keeping up nutrition, and also for making a distinct impression with quinine. As soon as the attack is

checked restorative measures must be carried out, and relapses guarded against by the judicious administration of quinine.

Malarial Hæmaturia.

The treatment of malarial hæmaturia—which term includes hæmoglobinuria—belongs really to the treatment of acute and chronic malarial poisoning. No American physicians at the present time have any doubt about the propriety of giving quinine in these cases, so that a consideration of that once-vexed question is unnecessary. On the other hand, the point may be raised whether the malarial nature of cases of hæmaturia is not sometimes assumed without sufficient reason, and whether some cases are not really due to distoma- or filaria-infection. For the purpose of settling this question proper investigations should be carried out. Within the last few years the subject of "hæmaturia from quinine" has been brought up again by physicians in Greece and Italy.[1] The unusual consequences of quinine in the hands of these men make it almost certain they did not have to do with malarial hæmaturia. If quinine at times seems to increase the blood in the urine, this is a matter neither for wonder nor alarm, since exacerbations of other symptoms also occur at times after the administration of the remedy.

In malarial hæmaturia, after acute malarial infection has been overcome by quinine in antiperiodic doses, the remedy should be kept up as a tonic. At the same time arsenic and iron should be given for the anæmia. It is commonly held that the chloride of iron is the best preparation to use in this condition, though the sulphate is also useful. Many experienced practitioners in the South and West look on strychnine as of little less importance than quinine, not only in the beginning, but also during the after-treatment.

Malarial Anæmia and Malarial Cachexia.

Practically, the line between simple malarial anæmia, the result of a few paroxysms, and the chronic condition, caused by prolonged exposure to the malarial infection, and intensified by mild or severe exacerbations, is of considerable prognostic importance. On the one hand we have a condition which yields readily to treatment; on the other we have an alteration of the physical and mental organization which may last for life.

The treatment of malarial anæmia should begin with the first paroxysm. At that time everything that can be must be done to limit the injury to the minimum, and after the paroxysms are checked the

[1] Pampoukis and Chromatianos, *Prog. Méd.*, No. 27, 1888; Tomasselli, *Gazz. Lombard.*, No. 5, 1889; Lipari, *Il Morgagni*, xxxi. 1889, p. 529.

attention of physician and patient must be directed to the restitution of health.

Some of the measures necessary for this have been described in the treatment of intermittent fever. It is essential that all complications be removed as rapidly as possible, and especially so all those which compromise the efficiency of the organs of digestion. Prominent among these are subacute or chronic inflammations of the stomach, intestines, and liver. These must be treated by the use of unirritating food, local sedatives like nitrate of silver, ammonium chloride, and bismuth, and by avoidance of chilling. Milk diet is often useful, and alkaline mineral waters can be used with great advantage. In the catarrhal jaundice following malarial fever I have had very good results from the use of cold enemata, after the method of Krull, having one or two quarts of water, at about 60° F., injected every morning. In chronic congestions of the liver and gastro-duodenal tract it is useful to give calomel and ipecac, podophyllin, or aloin at intervals to produce a mild effect. Nitric or nitro-muriatic acid may be given in these cases with great advantage.

Iron and arsenic are almost always in order, and may be given in any way the practitioner may prefer to suit individual cases. They can with advantage be combined with strychnine and, if desired, quinine. In many cases small doses of bichloride of mercury produce the happiest results alone, or, better, with iron and arsenic.

A very efficient adjuvant in the treatment of malarial anæmia is change of scene. Very often removal from one part of a town to another seems to cause great improvement, though complete change of climate is still more effective. In malarial cachexia the latter is necessary. No rule can be laid down for the choice of climate. In some cases seashore, in others high and dry mountains, offer the best prospects of improvement. Individual preference or experience usually indicates the proper climate. In making a change of this kind the possibility of a recurrence must be borne in mind. If out of reach of a physician, the patient should be provided with quinine, and on the first sensation of malarial symptoms take a full dose.

Maclean speaks enthusiastically of massage in the treatment of local congestions in malarial cachexia.

Malarial Splenic Enlargement.

In cases of malaria of short duration the persistence of enlargement of the spleen after subsidence of acute symptoms is, probably with justice, ascribed to the existence in it of latent germs. It can therefore be used as a guide to therapeusis, and usually yields to full doses of quinine. In cases of long standing the spleen undergoes a hyperplasia which is never entirely reduced. In recent cases the danger of

rupture of the spleen from even mild traumatism must be borne in mind. Recoveries from this accident show that in cases in which it happens, when promptly recognized, attempts to check the hæmorrhage by means of abdominal section are justifiable.

For pain in the splenic region warm cataplasms or warm baths with cold douches are useful.

For the reduction of chronic enlargement, in addition to quinine and arsenic, ergotin may be injected hypodermically in daily doses of from 3 to 5 drops. Though I have never had an abscess from a hypodermic injection of any kind, and have never seen any bad result from diagnostic aspiration of the spleen, I must confess I would not care to risk an infection of the latter organ by repeated injections, as recommended by Mosler. Other remedies for splenic enlargement, such as potassium iodide and bromide and iodide-of-mercury ointment, are now seldom used.

Masked Intermittents.

Under the name of masked intermittents, or *malaria larvata*, an innumerable host of symptoms or diseases have been described as depending on malarial infection. I do not refer to surgical or obstetrical malaria, under which absurd names some writers, even in recent times, have described certain septic or pyæmic conditions.

The principal reason for the assumption of a malarial origin in these cases is that they are intermittent or periodic. Without wishing to deny that the malarial germ can cause a coryza (Martin[1]), an orchitis (Martin and Charvot[2]) or urethritis (Weber[3]), I do not think satisfactory proof has yet been brought forward as to the malarial nature of the cases in question. Most frequently masked malaria is assumed in neuralgias. In regard to this (and the arguments apply to all the other so-called "masked" cases), it may be said that it frequently occurs in those places where other forms of malaria are almost unknown, and rarely in malarial localities; it does not yield readily to quinine. I have examined the blood of a number of cases of intermittent neuralgia with negative results, and Osler has had a similar experience.

According to Mitchell,[4] "Neuralgias common to all nerve-injuries are apt to reflect a quotidian type, and to occupy the later hours of the day. Non-malarial neuralgias are never tertian or other than quotidian."

The assumption of a malarial origin for an intermittent neuralgia or other disease or symptom should therefore be permitted only after a

[1] *Aerztl. Erfahrungen üb. die Malaria der Tropen-Laender*, Berlin, 1889.
[2] *Rev. de Chir.*, 1888, No. 8.
[3] *N. Y. Med. Rec.*, Sept. 12, 1885.
[4] *Injuries of Nerves*, 1872, p. 195.

thorough examination and exclusion of all other causes. When the malarial theory is accepted, treatment should be carried out on the principles already laid down.

Neuralgia and many other nervous symptoms are common in cases of malarial anæmia or cachexia, without being periodical. They yield to quinine, especially when combined with iron, arsenic, and other tonics.

In neurasthenia of malarial origin phosphoric acid and hypophosphites may be used, with such general and dietetic treatment as is usual in similar cases of different origin.

DENGUE.

THE rational indications in the treatment of dengue are to relieve pain, to mitigate the severity of symptoms, and to support strength and hasten convalescence.

The experience of the last two years shows that the recognition of dengue is no easy matter, and its resemblance to the pandemic influenza of those years points to certain methods worthy of adoption whenever it may again show itself.

Most writers in past years agree as to the benefit of purgatives in the beginning, though these should not be so severe as to increase the pain or lead to undue exposure of the patient. A mild saline or mercurial laxative may be given.

Notwithstanding the apparent insignificance of the disease, the patient should be put to bed in a comfortable room and draughts avoided. For the relief of pain morphine or some other opiate has almost always been relied on, Dover's powder being a favorite preparation. Formerly the pain in the joints and spine was treated by liniments and lotions containing belladonna, camphor, chloroform, and opium. According to Matas,[1] they are useless. Headache may be relieved by mustard foot-baths, cold applications, cold douches, and bromide of potassium in full doses.

Carbolated lotions have been used to lessen the itching from the eruption. For this and all other depressing symptoms morphine, and at times chloral, may be used with great advantage.

In the hot stages the febrifuges formerly in use, such as aconite, acetate of ammonium, and the like, are now obsolete. The cold bath is more effectual. But it is among the newer antipyretics that we must look in future for remedies against dengue.

Salicylates have been used with some success in the South and in the Eastern hemisphere, and, especially in the rheumatic forms, are

[1] Keating's *Cyclopædia of the Diseases of Children*, art. "Dengue."

worthy of further experiment. Salol seems to be the best preparation for this purpose. Of other antipyretics, antipyrine seems to be the only one so far used, and in the hands of DeBruns, with success.[1] But from analogy it seems that antifebrin and phenacetin may be found to be still better.

As soon as the acute stage of the disease is past measures must be taken for restoring strength. The appetite and digestion must be spurred by bitters, such as gentian, calumbo, and cinchona. Strychnine is also very useful, and may be combined with mineral acids. Coca, in the form of wine or as the fluid extract, combined with bitter tinctures, may also be recommended. Exercise and bathing are important adjuvants, and change of scene, especially in a bracing mountain atmosphere, is one of the most effective measures for overcoming the enervation and prostration so marked in convalescents from this disease.

[1] *Semaine. Méd.*, Mar. 6, 1889.

YELLOW FEVER.

By JEROME COCHRAN, M. D.

Introduction.

The literature of yellow fever is immense. In the forty-five octavo pages in which La Roche gives the bibliography of it up to his day, there are nearly one thousand titles; and in the Index Catalogue forty-four quarto pages are devoted to the yellow-fever literature stored away in the great medical library of the Surgeon-General's Office in Washington. I have had little occasion, however, to consult books in the preparation of this article. Personal experience has made me familiar with the methods of treating yellow fever which have found favor with the physicians of the Southern States during the last quarter of a century, and four of these Southern physicians, who have had large practical experience in yellow-fever epidemics, have favored me with special communications giving their individual views in more or less detail—namely, Dr. T. L. Ogier of Charleston, Dr. Thomas Grange Simmons of Charleston, Dr. G. B. Thornton of Memphis, and Dr. John P. Wall of Tampa. Of these communications I have made such use as will subsequently appear.

Looking more broadly over the ground, it occurred to me that it was especially desirable to get some knowledge of the treatment adopted in Havana, the perennial and endemic home of the disease, by physicians accustomed to meet it at all seasons of the year and for many years in succession.[1]

[1] Through the good offices of my friend Dr. Burgess I have been able to obtain communications from fifteen of the leading physicians of Havana, as follows:

Daniel Maynard Burgess, M. D., United States Sanitary Inspector.

Vincente de la Guardia, M. D., and Emilio Martinez, M. D., physicians to the Mercedes Hospital.

Diego Tamayo, M. D., Director of the Bacteriological Laboratory.

Carlos Finlay, M. D., and Claudio Delgado, M. D., who pay much attention to bacteriology.

José Clairac, M. D., physician in chief to the Military Hospital.

Manuel S. Castellanos, M. D., professor of Chemistry in the University of Havana.

José Rafael Bueno, M. D., physician to the Hospital La Benefica.

Enrique M. Porto, M. D., physician to the Out-door Poor.

Anthony Joner, M. D., physician in chief to the Hospital Quinto del Rey, and professor of Pathology in the University of Havana.

Since the first historical epidemics of yellow fever occurred in the West India Islands during the first half of the seventeenth century the treatment of it has undergone many changes. Some of these have been based on the results of the experience of physicians at the bedside, and others have been the legitimate offspring of the several theories of the essential fevers which have at different times obtained currency in the medical world. When acute visceral inflammations were believed to constitute the most characteristic features in the ultimate pathology of all of these fevers, bloodletting, purgation, and mercurialization were invoked for their relief, and at the same time, under the influence of these pathological doctrines, the same remedies were heroically employed in the treatment of yellow fever. When it was the fashion among the physicians of yellow-fever countries to believe that yellow fever was closely allied in its etiology and pathology with the common endemic malarial fevers of those countries, it very naturally became the fashion to treat yellow fever with antimalarial remedies, and especially with an abundance of quinine. Every system of treatment which thus enjoyed a temporary reputation has had its enthusiastic advocates, who have claimed that its superior efficacy has been shown in the speedier recovery of the sick and in the smaller percentage of deaths. No effort can be made here to give the history of these various methods of treatment. This has been done with tolerable fulness up to the year 1854 by La Roche in the thirty-third and subsequent chapters of his learned work. During the thirty-seven years that have passed away since that time, many new departures have been taken in the treatment of the great Southern pestilence; but these also must be passed over, except a few of the very latest of them, without special mention.

Under all of these methods of treatment the mortality of yellow fever has remained very great, and while in some epidemics the proportion of deaths to cases has been greater than in others, there can be no doubt, when all the circumstances have been considered, that these

Antonio Diaz Albertini, M. D., formerly physician to the Garcini Hospital.

Francisco Zayas, M. D., professor of Pathology in the University of Havana.

Besides these original authorities, I desire to make honorable mention of two books to which I have been considerably indebted:

(1) *The Type and Specificity of Yellow Fever.* By J. C. Faget, M. D., New Orleans and Paris, 1873 and 1875.

(2) *The Pathology and Treatment of Yellow Fever.* By H. D. Schmidt, M. D., Chicago, 1881.

The writers of these books, both of New Orleans, were my personal friends. Dr. Faget was the first to establish the type of yellow fever by the discussion of the pulse and temperature rates and the discovery of the want of correlation between them, which is rightly called Faget's law. In Dr. Schmidt's book there are many tiresome digressions, but I regard his pathological researches as the most satisfactory of which I have any knowledge.

variations have been due more to differences in the gravity of the epidemics than to differences of treatment. In the tables of mortality given by La Roche the percentage of deaths to cases in the great majority of the epidemics recorded by him ranges from 40 to 50; and this statement applies equally whether the epidemics were in tropical countries, in European countries, or in the United States. I am aware that epidemics have occurred with a percentage of mortality very much less than 40, and that occasionally the mortality has largely exceeded 50 per cent.; but the rule remains as I have stated it. In the yellow fever in Georgetown, Demerara, from 1851 to 1854, described by Blair, the percentage of mortality was only 13. It was in consequence of this remarkably favorable showing that Blair's calomel-and-quinine treatment was for a time so extensively adopted. But equally favorable results did not follow its use in other epidemics, and now nobody in any country treats yellow fever by Blair's method. In the mean time, the range of the pulse in Blair's cases, as recorded by himself, shows that this Georgetown fever was of a mild type. In contrast with this, the mortality at Barcelona in 1821 was about 70 per cent. of the cases. I wrote the history of the epidemic of 1873 as it occurred in seven Southern cities, and I found the mortality-rate to range from 20 to 25 per cent., but in Mobile it was only 15. In the widespread epidemic of 1878, which I studied in thirty different cities and towns, the mortality everywhere amongst the whites was from 40 to 50 per cent. of the cases. At Brewton, Alabama, in 1883, the cases were nearly all white, and the mortality-rate was 40 per cent. At Decatur, Alabama, in 1888, the mortality-rate among the whites was 30, while among the blacks it was only 8 per cent. In Jacksonville, Florida, in 1888, according to the best information I could get on the spot, the rate of mortality among the whites was about 20 per cent., while among the negroes, although the cases were very numerous, the death-rate was only about 2 per cent. Indeed, the epidemic which prevailed so extensively over the peninsula of Florida in 1887 and 1888 was everywhere of an extremely benignant type. At the same time, the treatment was expectant and symptomatic, and this may have had something to do with the remarkably low mortality-rate.

The Forms and Stages of Yellow Fever.

Yellow fever is always the same disease, but it is convenient to recognize it as presenting itself in three principal forms, which may be designated as follows:

(1) The mild or benignant form; in which it falls below the type and runs a favorable course to a speedy recovery.

(2) The typical or common form; in which it passes through all of

its several recognized stages, exhibiting more or less dangerous complications, and with a considerable percentage of deaths.

(3) The malignant, congestive, or apoplectic form; in which it transcends the type, and results in death in a few hours or a few days.

The several stages of yellow fever, which are completely developed only in the typical form, may be most conveniently fixed at three in number, as follows:

(1) The stage of effervescence; which has also been called the stage of reaction and the stage of primary fever. This stage commonly begins with a chill more or less marked.

(2) The stage of defervescence; which has also been called the stage of exhaustion and the stage of secondary fever. The beginning of this stage is commonly known as the period of calm.

(3) The stage of convalescence.

Yellow fever is a continued fever, a fever of a single febrile paroxysm, but this paroxysm is of very variable duration. It is not a paroxysm of which the length is usually about three days, as has been so generally stated. On the contrary, its usual duration in the typical form of the disease is from seven to ten days. Every table of yellow-fever temperatures that has been published shows this statement to be true beyond all controversy. It is the stage of effervescence only which usually lasts about three days—the stage of febrile commotion. In many mild cases this stage is less than three days; in a few severe cases it may be more than three days. But in the great majority of cases it terminates some time in the course of the fourth day. It is followed by that very notable characteristic of yellow fever, the period of calm, which is the beginning of the stage of defervescence. But the period of calm is not an afebrile period, is not an apyretic period. In it the stage of febrile commotion, the stage of rachalgias and cephalalgias and universal turmoil and discomfort, gives place to a period of delightful exemption from all these troubles. The patient feels as if he was already convalescent. His appetite returns, and it is sometimes not easy to prevent him from perpetrating some alimentary imprudence. He often desires to get out of bed, feeling that further confinement is not necessary to his welfare. As a matter of fact, in favorable cases of the benignant form convalescence does often date from this time, and the fever disappears rapidly, to return no more.

But in the typical form the line of febrile temperature, as shown by the clinical thermometer, simply continues the declension which in the majority of cases was begun a day or two earlier during the stage of febrile effervescence, and several additional days must pass away before the line of normal temperature is reached. If the case is at all severe, the falling temperature does not stop at the normal line, but goes below it a degree or more. In the majority of cases of the typical form—

cases in which the complications are not of special gravity—the stage of defervescence passes into the stage of convalescence and the patients recover. But in a considerable number of cases, before the defervescence is complete, it is interrupted by various complications—by suppression of the secretion of the kidneys, by black vomit, by septicæmia, and by uræmia, and the patients die.

The Havana Treatment of Yellow Fever.

There is considerable diversity of opinion amongst the physicians of Havana in regard to the details of the treatment of yellow fever. Most of them, however, are agreed as to the propriety of eliminative, antiseptic, and antacid medication. Elimination and antisepsis are practised upon the assumption that the yellow-fever microbe has its habitat in the stomach of the patient or in some part of the small intestine, while the antacid medicines are intended to correct the acid diathesis which is so marked in this disease.

It must be remembered that Havana physicians study yellow fever under conditions very different from those that obtain when yellow fever visits this country. With us it is nearly always epidemic, an imported pestilence which spreads rapidly amongst the people, carrying panic upon its wings. But yellow fever is never epidemic in Havana. There it attacks only unacclimated strangers, and has no terrors for the permanent population of the place. In Havana, therefore, yellow fever can be studied with scientific deliberation and thoroughness, while we have to study it in the rush and hurry and excitement of pestilential invasion.

In the discussion of the treatment of yellow fever in Havana, I have thought it best to use the very words of my Havana correspondents, only turning into English the Spanish language used by most of them. In justice to these gentlemen, it must be remembered that they have not attempted in these communications to write systematic treatises on the treatment of yellow fever. They have only given brief and hurried expression to their most important opinions, without any attempt at literary finish; and what they have said is all the fresher for this, and all the more instructive.

Treatment of Yellow Fever by Dr. Burgess.—"During my residence of over twenty years in Havana, much of the time attached to a hospital as visiting physician, besides being engaged in a considerable private practice which was of a character sufficiently foreign to allow yellow fever to develop in it, it has been my fortune to see the rise and fall of quite a number of methods of treating the disease, some of which were based on more or less plausible theories. If a method or remedy happened to be launched when the *genius epidemicus* (so to speak) caused a large proportion of cases of the first or

benignant form (of the three classes into which you have so correctly divided cases of yellow fever), and few of the second form and scarcely any of the third, the reputation of the method or remedy was sufficiently established to allow it to remain in vogue until an epidemic should come along in which large numbers of the second form occurred, some of the third or malignant form, and not many of the benignant form, when the great mortality would destroy faith in the system and the remedy would be abandoned.

"Little or nothing having been known as to the actual cause of yellow fever, I, until about three years ago, in common with many physicians here of good repute for the management of that disease, was in the habit of treating it upon the expectant or symptomatic plan, making use of emetics, purgatives, diuretics, and diaphoretics—an eliminating medication.

"About three years ago it began to be felt that at least a portion of the treatment of yellow fever could have a scientific basis. It was known that the contents of the stomach and intestines, the urine and perspiration, and the whole body, so to speak, were in an intensely acid condition in that disease. It was also believed by many, and suspected by more, that one of the microscopic organisms found in the stomach and intestines was in some way associated with the pathogenesis of the disease. With these views our friend Dr. George M. Sternberg, who was here at the time making researches as to the etiology of the fever, advocated the use of bicarbonate of sodium as an antacid or alkali, and some germicide, preferably bichloride of mercury on account of its well-known powerful germicidal and antiseptic properties and its want of taste and smell. We were very confident that the bicarbonate of sodium would be found of great service, and had strong hopes from the bichloride, but not to the rejection of other germicides. In consequence of this reasoning the following system of treatment was at once adopted by me, with results so satisfactory that during the last three years I have had no desire to change it:

"When I am called to a case suspected to be yellow fever and more or less of the typical form, I at once proceed to empty the stomach and intestinal canal by the administration of an emetic of ipecacuanha when the presence of undigested food is reasonably suspected or if the tongue is coated and foul. As soon as the emetic has had its effect and the attendant nausea has subsided, either by itself or under the soothing influence of a cup of tea or the like—say in three or four hours—some kind of a purge is given, generally oleum ricini, citrate of magnesium, or a saline. About the time the purge begins to act, or even before if its action is at all delayed and has to be helped, I begin with Sternberg's mixture, and give it ice cold, every hour as near as may be, for from four to seven or eight days, usually diminishing the amount about

the fourth day, particularly the amount of the bichloride, and frequently leave this out altogether on the fifth day. All drinks are given ice cold, and, as this mixture is given every hour, no great want is felt for other fluids. No food is allowed until about the fourth or fifth day, when milk or broth may be commenced with, slowly and cautiously and in small quantities at first.

"The alkaline mixture has a strong diuretic action, and under its influence the albumin is apparently better held in solution, and the danger of suppression of urine and uræmia is diminished. As a rule it has also more or less of a laxative effect, occasionally so great as to necessitate its diminution or temporary suspension.

"With the use of this remedy there is apparently less gastralgia, intestinal pains, and gastric discomfort than attend other methods of treatment.

"In considering the treatment of yellow fever under your three stages, I will discuss the question as follows:

(1) "*Treatment of the Chill and Primary Fever—the Period of Effervescence.*—The chill is often absent, and, being generally moderate and of short duration when it occurs, little attention is paid to it. If the patient is plethoric and exhibits symptoms of cerebral congestion, I would approve of the hot mustard foot-bath and hot drinks. In any event, give the preliminary purgative promptly, and after a few hours begin the administration of Sternberg's mixture. No food, no alcoholic stimulants, no hypnotics, and no nervous sedatives. Cold drinks should be given. There is never any collapse in this stage, and, so far as I have seen, heart tonics are not needed. If the headache is severe, apply cold vinegar and water to the head. If the temperature is over 104° Fahr., apply cooling lotions to the surface of the body.

(2) "*Treatment of the Stage of Calm and Defervescence.*—Continue for a few days longer the alkaline and germicidal mixture of Sternberg, and give cool drinks. During the early part of this stage stimulants are rarely needed. A little later milk and broth may be given cold, and when symptoms of debility become manifest stimulants may be carefully administered.

(3) "*Treatment of Convalescence.*—If the heart's action is very slow, the patient should not be allowed to make any exertion whatever. Convalescence is usually rapid, and should be treated as that of other serious diseases, but with greater care in respect to food, which should be of an unirritating character and easily digested, such as milk and broth. Bitter tonics for the appetite, tincture of chloride of iron to improve the condition of the blood, and a little alcohol in some pleasant form, as sherry wine.

(4) "*Special Indication.*—To sustain the failing energy of the heart and prevent collapse, digitalis, nux vomica, alcohol, citrate of caffeine, and hypodermic injections of sulphuric ether may be used. To relieve

the gastric irritation before and after the advent of black vomit, ice, cold drinks, iced champagne, counter-irritants to the epigastric region, and hypodermic injections of ergot are useful. To quiet nervousness and insomnia, bromide of potassium and chloral may be given."

The formula for Sternberg's mixture is as follows:

R. Hydrarg. chlor. corros.,	gr. $\frac{1}{3}$;
Sodii bicarbonat.,	ʒiij;
Aquæ fontis,	Oij;
Misce et adde	
Alcohol.,	fʒj.

Sig. Two to three table-spoonfuls, ice cold, every hour.

Rivière's anti-emetic potion is prepared as follows:

Solution No. 1:

R. Potassii bicarbonat.,	ʒss;
Syrupi,	fʒss;
Aquæ,	fʒiij.
M. ft. in solution.	

Solution No. 2:

R. Acid. citric.,	ʒss;
Syrupi limonis,	fʒss;
Aquæ,	fʒij.
M. ft. in solution.	

Sig. A table-spoonful of Solution No. 1, followed at once by one of Solution No. 2.

The Treatment of Yellow Fever by Drs. La Guarda and Martinez.—"In order that our statements in regard to the treatment of yellow fever may be rightly interpreted, we prefer to give beforehand the facts and theories upon which our treatment is based.

"We believe that there are three forms:

"(1) The mild form, which runs into convalescence after the remission of the fever on the fourth day.

"(2) The common form, which runs into the second stage of fever, and has a duration of eight or ten days.

"(3) The severe form, which has a duration of three or four days, and ends in death by rapid uræmia. We have never seen a case that has died in less than three days, but we suppose deaths occur sometimes earlier in epidemics.

"We recognize only three stages:

"(1) The primary stage, which includes the chill and the primary fever up to the remission of the fourth day.

"(2) The secondary stage, which includes the secondary fever and the complications.

"(3) The stage of convalescence.

"We consider yellow fever to be an infectious disease, which confers subsequent immunity on those who have suffered an attack of it. The agent of infection—so far unknown—is a germ that probably enters the intestinal tract with the water or with contaminated food, or it possibly floats with the dust in the air. This germ multiplies in the intestinal tract, and secretes or forms ptomaïnes which are rapidly absorbed into the blood, producing fatty degeneration of all the viscera, more especially of the liver, the kidneys, and the capillary blood-vessels. Hence the line of treatment we follow is based on two principal indications: (1) to evacuate the intestinal tract; and (2) to assist the viscera to eliminate the ptomaïnes that were absorbed into the blood. These notions of the disease have been greatly influenced by the investigations of Dr. George M. Sternberg, and his treatment will fully satisfy us until the unknown germ is found and some specific treatment is devised to take its place.

"Suppose we had to treat a case of the common form, we would proceed as follows: We see the patient a few hours after the chill, and we at once administer an emetic of ipecacuanha. After free vomiting we give the patient three hours' rest, and then prescribe calomel and jalap, of each 1 gramme—15 grains—divided into two powders, and taken with one hour's interval between them. After the first stools we commence with Sternberg's mixture, giving a small glassful, 145 grammes, ice cold, every hour day and night. Sometimes we omit the bichloride of mercury in this mixture. After the fourth day we begin to diminish the bicarbonate of sodium, and we suspend it wholly after the eighth day. We give then a stimulant, such as the cognac mixture, which is made as follows:

℞. Ext. cocæ fluid., f℥ss;
Cognac, f℥ij;
Infusion. caffæ, f℥iij.—M.
Sig. A table-spoonful every two hours.

"The *rationale* of this treatment is as follows: With the emetic and purgative of the first day we get rid of much of the offensive material from the alimentary canal. The alkaline mixture has the double purpose of neutralizing the acid media of the stomach and bowels, and is at the same time an excellent diuretic, which helps to eliminate the ptomaïnes and to keep the kidneys in function. We give plenty of ice-water and bits of ice. As to diet, on the first two or three days we give nothing at all; after that small quantities of iced milk or broth.

"We do not pay any attention to the fever as a mere symptom at any stage of the disease, as it is never so high or so prolonged as to endanger life; and it is far better to attend to the cause of the fever and to free the intestines from the poisonous germs and ptomaïnes. We give no hypnotics. On the contrary, we awaken the patient every hour during the main part of the treatment to give him his medicine. We seldom have occasion to give purgatives after the first day, as the large doses of bicarbonate of sodium move the bowels somewhat. If we should not have at least one stool every day, we give enemata. On the other hand, in cases in which the large doses of the bicarbonate produce diarrhœa, we diminish the amount, because the occurrence of the diarrhœa shows that it is not absorbed; we fail, therefore, to get its diuretic action, and there is danger of uræmia. We do not consider diaphoresis to be desirable, as it diminishes the renal function, which is more important. In debility of the heart and collapse we give a mixture of coca, cognac, and coffee. Uræmia is the principal cause of death in yellow fever. The bicarbonate of sodium sustains the action of the kidneys. Acetate of potassium is sometimes given. Quinine has been extensively used in yellow fever, but has proved of no benefit, and is now abandoned. It increases gastric irritation and embarrasses the function of the kidneys. We regard opiates as dangerous, because they reduce the volume of urine eliminated and induce constipation, thereby diminishing the excretion of offensive material from the bowels. The fluid extract of ergot is used hypodermically to check profuse hæmorrhages. Beta-naphthol has been used by a physician of this city as an intestinal antiseptic, but with no better result than that which follows the common symptomatic treatment."

Treatment of Yellow Fever by Dr. Tamayo.—"In a work that I presented to the First Medical Congress of the Island of Cuba, which was held in the month of January, 1890, I gave a summary of my manner of interpreting the pathogenesis of yellow fever in the following words: 'Yellow fever is an infectious disease of which the infecting germ finds its field of cultivation in the stomach, where the germ finds a place for the production of ptomaïnes or of diastases, which not only induce alterations in the mucosa by local action, but which, passing into the intestines, are absorbed, thereby engendering the general phenomena of the toxic infection.'

"From this fundamental conception of yellow fever is derived the treatment I habitually practise. In its benignant form yellow fever is reduced to a gastro-intestinal catarrh, which can be relieved by any rational treatment.

"In the majority of cases my treatment is as follows: Emulsion of castor oil made aromatic with essence of peppermint, one ounce of the oil to be taken every three hours (or oftener if deemed

necessary), and with it 50 centigrammes (equal to $7\frac{1}{2}$ grains) of calomel. In the intervals give pastilles of salol with bicarbonate of sodium and citric acid. When these are placed in contact with a liquid the citric acid reacts upon the bicarbonate with liberation of the carbonic acid, scattering the salol, a useful soluble antiseptic, which by virtue of this property reaches the intestines mixed with the materials dragged along by the evacuants. Give cold water freely, encouraging the patient to drink the largest quantity possible. Apply constantly to the epigastrium a cold compress covered by an impermeable cloth, which determines congestion of the skin and augments the local temperature, and, besides, stimulates the functions, digestive and motor, of the stomach. If on the application of the compress the sensation of cold persists without the occurrence of the hydrotherapeutic reaction, then arrange around the compress a thick rubber tube filled with water at 38° to 40° C. (equal to 100° to 104° Fahr.), and the reaction appears rapidly. This is the most efficacious means for the prevention of vomiting and gastralgia.

"This is my treatment during the first stage of the fever, the stage of effervescence, and I propose with it—1st, to scour with the evacuants the intestinal tube; 2d, to modify the gastric medium by the presence of the calomel, the salol, and the mint; and, 3d, to augment the vascular tension by the ingestion of large quantities of water, making active in this way the emunctories of elimination, to which also the diuretic action of the calomel contributes.

"At the beginning of the remission, or stage of defervescence, I sustain the intestinal elimination with repeated doses of sulphate of sodium, and persist in the use of the salol, watching the urine, and besides give coffee and benzoate of sodium. I continue the cold applications to the epigastrium, and administer large enemas of cold water with sulphate of sodium. I propose to keep the gastro-intestinal canal always clean, and to keep open this potent channel of elimination; to modify as much as possible, and permanently, the medium in which the infectious germs live; and to secure intestinal asepsis if possible. The benzoate of sodium makes soluble the extractive products existing in the organism, on account of both augmented production and retention, the benzoic acid reacting on the uric acid and eliminating it in the form of hippuric acid, which is perfectly soluble. The coffee I regard as an indirect aliment, a disinfectant, and a cardio-vascular tonic.

"I continue with this treatment up to the beginning of the convalescence, in which I maintain the intestinal elimination by the sulphate of sodium, and administer quinine in combination with wines like sherry. The alimentation during the whole sickness is invariably milk, which is used always very cold and with a free hand.

"*En résumé:* Yellow fever is an infectious gastritis, and the treat-

ment has for its object to combat this gastritis; to modify the medium in which the infectious germs live and develop; to impede as much as possible the multiplication of the germs; to eliminate by the great intestinal conduit the microbial products and the organic *débris* which is deposited as an alluvium in the irritated tissues; to sustain with prudence the renal elimination; and to give power to the organism to resist both the original toxic infection and the secondary autogenous infection.

"With this treatment excellent results have been obtained during the last three years, in which yellow fever has been variously modified.

"The wet compress on the epigastrium is applied according to the method of Professor Winternitz of Vienna. The folded compress is squeezed out of cold water and spread over the epigastrium, and is then covered with some impermeable tissue, as oil silk or rubber cloth. The first sensation is, of course, of cold, but presently the humid compress acts like an irritant to the skin, provoking active fluxion in the cutaneous vessels, and so finally brings about the local augmentation of temperature."

The salol tablets are composed as follows:

℞. Salol,	gr. iij;
Sodii bicarbonat.,	gr. iij;
Acid. citric.,	gr. iss.—M.
Ft. in tabel. No. 1.	

The three ingredients must be very dry before they are mixed together. The largest amount of salol given by the author is 9 grammes (138 grains) in the twenty-four hours. This would be equivalent to one hundred and thirty-five tablets.

Treatment of Yellow Fever by Drs. Finlay and Delgado.—"In order to explain the principles on which our treatment is founded it seems necessary to describe the three clinical forms under which we classify all yellow-fever cases. These forms are—

(1) "The non-albuminuric form, which is characterized by the absence of albuminuria during the whole course of the disease, or if it appears at all it is of insignificant quantity and ephemeral duration. These cases all recover.

(2) "The simple albuminuric form, which is characterized, on the one hand, by the presence of albumin in the urine after two or three days of fever, and on the other hand by the absence of gastric complication during the advanced stage. The great majority of these cases recover.

(3) "The gastric and albuminuric form, also called by us the melano-albuminuric form, which is characterized not only by the presence of albumin in the urine, but also by the occurrence of gastric complica-

tions when the disease is at its height or apparently on its decline, such as black vomit, or the ejection of similar material through the bowels, or indications that such products are retained in the stomach or intestines. Almost all the fatal cases belong to this form, which we attribute to a secondary infection originating in the gastro-intestinal tract. Our principal efforts in the treatment are directed, therefore, toward warding off this dreaded localization of the morbid process in the digestive organs, by clearing these organs of all offensive matters, and by affording them functional rest during the evolution of the disease.

"Our plan of treatment is as follows: As soon as possible after the invasion a purgative is administered, preferably of castor oil beaten up with lemon-juice, to be repeated the same day if necessary to secure the complete evacuation of the bowels. Should the intolerance of the stomach be too great to allow the retention of the oil, fractional doses of seidlitz powder in iced water will sometimes enable the oil to be subsequently retained. Enemas may be used to hasten the purgative action. After the bowels have been thoroughly cleaned out no other purgatives are given, but the enemas, of emollient decoctions or of weak solutions of boric acid, are continued every twelve hours. As soon as convenient after the purgative dose 4 grains of beta-naphthol are administered, and repeated every six hours. Each dose of naphthol is followed by 8 grains of bicarbonate of sodium, and two hours after each dose of the bicarbonate a table-spoonful of a 2 per cent. solution of hyposulphite of sodium is administered. The three medicines are continued in the same order during the first four or five days.

"As a drink we give boiled water, cool or iced, and flavored if desired with lemon, orange, or pineapple juice. No food of any kind, solid or liquid, is allowed before the fourth or fifth day, not even in mild cases. Small enemas containing from 8 to 16 grains of chloral constitute an appropriate hypnotic. Valerian and the bromides are often prescribed as nervous sedatives.

"Hypodermic injections of ergot sometimes do wonders in severe hæmorrhagic cases with copious black vomit, but they appear to do harm when dyspnœa has set in. Blisters to the pit of the stomach and bits of ice kept in the mouth allay the gastric irritation of the advanced stage. Mercurials, quinine, and opium or morphine we consider more injurious than beneficial as a rule, but we have occasionally prescribed a dose of calomel at the beginning as the only purgative that could be retained. Antipyrine we employ only when required to keep the fever below 40° C. (104° Fahr.) in the first stage. Hot foot-baths, cold applications to the head, chloroform liniment to the loins and limbs, are sometimes useful on the first and second days; sometimes leeches behind the ears may be required.

The Treatment of Yellow Fever by Dr. Clairac.—(1) "I advise the foot-bath in cases of violent chill or of violent cerebral congestion, and also encourage the use of warm drinks with the object of promoting active diaphoresis. I prefer emetics to purgatives at the beginning of the treatment if the condition of the digestive tract of the patient needs them. I prefer the saline purgatives. The fever subsequent to the chill I treat generally with sudorifics and vapor baths, sustaining the laxative effect for the first and second days, and disinfecting the gastro-intestinal tube with beta-naphthol, salol, and salicylate of bismuth. By no means in this first stage use ice, lotions, frictions, febrifuges, sedatives to the nervous system, hypnotics, diuretics, cardiac tonics, or alcoholic liquors. I have never seen collapse in this stage of the disease. Absolutely no food must be given.

(2) "During the remission, when it exists—which is in very few cases—continue the treatment begun in the previous stage. Give no food. Do not give stimulants. Continue the antisepsis of the intestinal tube. I have never obtained any advantage from the employment of quinine or any other febrifuge. If the fever persists or presents itself anew after the remission, I employ alcoholic tonics; cold lotions of aromatic vinegar or aromatic gin and cold water, equal parts; cold acidulated drinks; and clysters of cold water slightly acidulated; under no circumstances do I give purgatives. General treatment is proper for the other pathological phenomena that may present themselves.

(3) "The period of convalescence necessitates care analogous to that given to patients recovering from other grave diseases; but recovery from yellow fever is usually rapid.

"To sustain the energy of the heart the best medicine, in my judgment, is citrate of caffeine. For gastric irritation cold seltzer-water, cold champagne, champagne frappé, a triangular blister to the epigastrium, the anti-emetic draught of Rivière, alone or with the addition of hydrochlorate of morphine; and if passive hæmorrhages and black vomit are frequent and abundant, 100 drops of fluid extract of ergot in one table-spoonful of cold water. For nervousness and insomnia give bromide of potassium, morphine, and extract of opium. The effect of quinine is negative if not prejudicial. Under the use of antifebrin and antipyrine the temperature does not always descend, and in grave cases in which there is a fall in temperature it lasts but a short time, to mount again rapidly.

"The question of restoring the functions of the kidneys when albuminuria and growing scantiness of urine threaten danger is one which I consider the most important of all and the most difficult to answer. The renal functions are of great importance in

the physiological pathology of yellow fever. The result most grave is the uræmia, and the suppression of the function of the kidneys comes as a consequence of this, usually in a short time. Against this condition our therapy is almost impotent. The most active diuretics have little effect in such cases.

"The presence of albumin in the urine is a phenomenon constant and pathognomonic of yellow fever, and the post-mortem lesions of the kidneys are extensive and grave."

Treatment of Yellow Fever by Dr. Castellanos.—"I feel authorized by a practice of more than twenty years as physician to the Tacon Theatre, where I frequently attend cases among individuals of foreign theatrical companies, to state that there exists no specific treatment for yellow fever; that the plans of treatment followed successfully by some practitioners fail when employed by others; and that the results of treatment frequently depend on the meteorological conditions prevailing at the time of the attack.

(1) "*The Stage of Effervescence.*—I begin at once with the administration of a purgative, giving preference to the salines, and amongst these to the citrate of magnesium. One of the objects of the purgative is a derivation of the congestion from the brain to the intestines. After the advent of the fever the principal medication employed is the bicarbonate of sodium in large doses—from 2 to 4 grammes (30 to 60 grains)—in the twenty-four hours, with the view of trying to render the blood alkaline; and in connection with this a symptomatic medication depending on the form assumed by the fever, on the constitution of the patient, and even by his course of life anterior to the attack, the use of drastic purgatives being very frequent. I have never used ice to the head or cold lotions, fearing that their subsequent effect would be to favor the cerebral congestion. I have often used diuretics, preferring the citrate of potassium—40 grains in the twenty-four hours—without employing heart-tonics. At other times I have used febrifuges when there was a predominant malarial tendency, but never alcohol, unless in the form of the weaker wines when the predominant tendency of the disease is adynamic. Absolutely no food is to be given throughout this stage.

(2) "*The Stage of Defervescence.*—The management of the patient during this stage must also be regulated according to the form of the disease. If congestive symptoms predominate, alimentation must be very scanty—hardly 4 or 6 ounces of milk in the twenty-four hours; but if, on the contrary, the predominant symptoms are adynamic, the patient may be given even much more milk and some 10 ounces of broth. Cold acid drinks, with a preference for sulphuric-acid lemonade, may be taken abundantly. Stimulants are hardly ever indicated, of whatever class they may be.

"If the urine shows the presence of albumin, antiseptics should be used, such as beta-naphthol, phenate of sodium, or resorcin, and these may be combined with the sulphate of quinine. Or Sternberg's mixture may be used, which has, I believe, given me the best results. For the black vomit iced drinks must be used and the perchloride of iron administered. When syncope exists or obstinate singultus is present, these symptoms may yield to the use of hypodermic injections of sulphuric ether, and to blisters on the hypogastrium.

(3) "*The Stage of Convalescence.*—If the form has been benign or of moderate intensity, the patient may be allowed broth, milk, and wine: but if the form has been grave, it is necessary to be very careful with the alimentation, as there is danger of indigestion producing a relapse which is almost always fatal.

"Usually, when the urine becomes scanty and with abundant albumin, the chances are that complete suppression will supervene with the train of phenomena attendant on uræmia, and with a fatal termination of the case. Under such circumstances, although without much hope of benefit, we give diuretics and antiseptics in large doses.

"Of all the medicines used as hypnotics, the best in yellow fever, according to my judgment, is sulphonal, as it not only quiets the nervous excitement and induces sleep, but it leaves no stupefying effects like narcotics. As to oil of turpentine, creasote, ergot, digitalis, and chloral, I do not think that any of them have any importance in the course of this disease. I have not used opium or morphine."

The Treatment of Yellow Fever by Dr. Bueno.—"In the course of fourteen years of practice as physician to the Hospital La Benefica I have had occasion to test the value of most of the methods recommended for the treatment of yellow fever—methods which, according to their authors, had produced wonderful successes. These methods in my hands have not accomplished the announced results. Far from that, my statistics have been very different from those so often obtained by others, and my rate of mortality has been largely determined by the epidemic constitution of the several seasons. The intestinal antiseptic method with beta-naphthol gave a colleague last year only 15 per cent. of mortality, as he announced in the papers, but it gave the year before 30 per cent. of mortality at La Benefica. The method of Dr. Sternberg, in a clinic at the Mercedes Hospital, gave 15 per cent. of mortality, and at the Hospital Garcini the same method gave a mortality of 38 per cent., while at the same time symptomatic treatment and expectancy gave 15 per cent. of mortality. To what are these differences due? To two causes: The first, signalized by Dr. Weiss in the Cuban Medical Congress, is the epidemic constitution of the various seasons or the genius of the epidemic itself, which gives good and bad results, and always in series.

The second is the self-conceit and vanity of the authors of the treatments.

"In my clinic at La Benefica I rely on the purely expectant method, and when I am forced to do so I fight against symptoms, so that my treatment is that of an armed expectancy. In the benign form of yellow fever I do nothing except to give an emetic and a saline purgative. The very grave or siderant form does not give you the opportunity to do anything that helps the patient. The common or typical form is the field of operation of all the founders of treatments. It is here that the influence of medication can be better appreciated and the results of treatment better judged.

"In this form I always administer an emetic at the beginning of the attack, and follow this by a saline purgative on the second day. Besides this, I give alkaline drinks, employ frictions to quiet the lumbar pains, and administer antipyrine for the relief of the headache. I may add here that I have not seen the antipyrine cause diminution in the quantity of the urine during the first stage of the fever. In the mean time, it brings great relief to the patient. To prevent too great elevation of the temperature I use cold drinks and affusions of aromatic vinegar.

"During the period of calm I continue the alkaline drink, and if the emetic and cathartic of the first and second days have not produced abundant intestinal evacuations, give enemas of saline purgatives. In this period I begin the administration of food, preferably cold or frozen milk, which, besides its nutritive value, acts as a diuretic. I sometimes combine it with cognac or rum, or some other alcoholic liquor preferred by the patient, even when the heart does not show signs of debility. Throughout the period of defervescence the same plan is observed.

"For black vomit, blisters are applied to the epigastric region, and ice and champagne frappé are given internally. For the prevention of collapse, hypodermic injections of sulphuric ether and caffeine are useful. Insomnia and nervousness may sometimes be relieved by tepid baths. To restore the suspended function of the kidneys is always difficult if not impossible."

The Treatment of Yellow Fever by Dr. Porto.—(1) "*The Stage of Effervescence.*—Very few cases exhibit the initial chill in any decided way, and these are usually of the paludal type. I generally begin the treatment with a hot mustard foot-bath and a sudorific potion of acetate of ammonium, cognac, and tea. If there are coated tongue and nausea, I give an emetic of ipecacuanha, and the next day a purgative of citrate of magnesium or of sulphate of sodium. If the tongue is not coated, I give simply a saline purgative at the beginning. As soon as the fever is established the patient is

generally put on small doses of aconite in some cold acid drink—lemon or pineapple juice. If there is hyperpyrexia, lotions of aromatic vinegar to reduce the temperature, and cold compresses of the same to the forehead to alleviate the headache.

(2) "*The Stage of Defervescence.*—Give during the period of calm ice-water and milk; afterward a tonic mixture of extract of cinchona and cognac, alcoholic drinks, and milk, and if there is great elevation of temperature use cold affusions of aromatic vinegar.

"Gastric irritation and black vomit are treated with the anti-emetic potion of Rivière, and cold champagne and external revulsives. For the hæmorrhages I use fluid extract of ergot and perchloride of iron, and as a diuretic nitrate or acetate of potassium. For nervousness and insomnia combinations of bromide of potassium and opium are very useful.

"Ignorant of the pathogenic elements of this disease, typical in all its grades, the symptomatic medication is that which I prefer, limiting myself to the following principles: (1) To eliminate excrementitious matters by emetics and purgatives, and to keep free the digestive tube; (2) to sustain the natural powers of the patient; (3) to control the great elevations of temperature; (4) to combat the complications; (5) to maintain urinary elimination."

Treatment of Yellow Fever by Dr. Joner.—(1) "*Stage of Effervescence.*—During the chill, when there is a strong congestive headache, I approve of the hot foot-bath. I never give hot drinks, because they increase the temperature. I always use a purgative at the beginning—sometimes sulphate of sodium, 1½ ounces; occasionally castor oil, ½ ounce. In plethoric subjects, who have a thickly-coated tongue and complain of severe cephalalgia, I always give an emetic—40 grains of ipecacuanha—before the purgative. After the rise of the fever I allow cold drinks, and apply a mixture of vinegar and water to the forehead when there is violent headache. I also use the same mixture as a general lotion to lower the temperature when this rises above 104° Fahr. I never use hypnotics or sedatives internally. I take great pains to secure intestinal asepsis, using for this purpose salol in 5- to 10-grain doses every three hours; or at the same intervals 10- to 15-grain doses of beta-naphthol. Salicylic acid has not proved to be successful.

(2) "*The Stage of Defervescence.*—During the calm at the beginning of this stage the rule I follow is rest and expectation, with symptomatic medication. As the case progresses, milk diet may be allowed, and the bowels should be kept well open. If black vomit occurs, all food is suspended, and ice, cold seltzer-water, iced champagne, and Rivière's potion are used. A blister to the epigastrium or an ice-bag on the same region is a favorite remedy. As diuretics I use milk-

sugar, 4 ounces at a dose in a pint of hot water, pleasantly flavored. The acetate of sodium, 2 drachms; infusion of digitalis, 20 grains to 4 ounces of boiling water; carbolic acid, 10 drops at a dose in an ounce of glycerin; alcoholic stimulants in moderate quantities; and sinapisms or thermo-cautery applications to the lumbar region may all be useful.

"During convalescence great care is to be used in regard to food. Albuminuria is not in itself a contraindication to the use of animal food, but if it is accompanied by renal casts, then a strict milk diet must be maintained. The best remedies to sustain the failing energy of the heart are digitalis, alcohol, and hypodermic injections of caffeine or ether. Quinine I believe to be entirely worthless in yellow fever. Opiates I strongly oppose. Ergot hypodermically is a good hæmostatic—half a drachm of the fluid extract at a time."

The Treatment of Yellow Fever by Dr. Albertini.—"Yellow fever being an infectious disease, of which the pathogenic element is unknown to us, the natural result is that here, as everywhere, the medication has been, and still is, symptomatic, empirical, and routine. In this respect, after thirty-four years of practice, I have done nothing but apply the principles of general therapeutics to the special cases that have come within the range of my observation, without venturing to give the preference to any special method. From the purely clinical standpoint I am convinced that in yellow fever, as in the other infectious diseases, the success of the methods employed is subordinate to the degree of infection and to the constitutional power of resistance of the patient. But this does not prevent me from affirming that, of all the methods used in the treatment of this disease, the one that has left the best impression on my mind is that which by the exhibition of emetics, purgatives, diuretics, and diaphoretics constitutes an eliminatory medication."

Treatment of Yellow Fever by Dr. Zayas.—"As for the treatment of yellow fever, all the methods used here—and they have been most varied and sometimes most absurd—have given almost the same results, including also the expectant method; that is to say, none of them have perceptibly diminished the usual rate of mortality, which, besides, is very variable in different years, with no known explanation of the causes of such differences.

"Recently three agents have been used here experimentally in the treatment of this fever:

(1) "Internal washing of the organism. This is described by Dr. Sahli in *La Semaine médicale* of Paris. Although he does not speak of it in its application to yellow fever, yet he states that it has a powerful influence in augmenting the quantity of urine in cases of uræmia, which is one of the gravest complications of yellow

fever and one of the most serious prognostic symptoms. (2) Cocaine, given a few minutes before taking food, in doses of 2 centigrammes —$\frac{1}{3}$ of a grain—to prevent vomiting and epigastric distress. (3) Oil of turpentine, in capsules, in the icterus with ischuria and grave symptoms of uræmia. We can affirm nothing as yet as to the efficacy of these new agents."[1]

The American Treatment of Yellow Fever.

Hygienic Management.—The hygienic management of yellow fever is the same for all the forms of the disease, with the proviso that in the severer forms greater care must be taken to carry out thoroughly all the rational indications. The yellow-fever patient should be placed in a cool, airy, and well-ventilated apartment, without carpets or mats. His bed should be furnished with a good, pleasant, springy mattress, without feathers, and the covering should be just enough for comfort. Heavy blankets and all excess of covering are mischievous. It is necessary to emphasize this caution, because people generally are under the impression that yellow-fever patients should be so warmly covered as to keep up a profuse perspiration; and the physician will have to be very positive to induce them to comply with his wishes in this respect. All that is desirable in this direction is that the skin should be kept soft and very slightly moist. Profuse perspiration is always to be avoided. Perspiration in yellow fever is never critical, and exerts but little influence in lowering the temperature. If the patient is restless and uncomfortable and insists on kicking off the cover, it is better that he should be allowed to have his own perverse way than to keep him annoyed by continually pulling the cover over for fear he may take cold. Such restlessness is an unfavorable symptom, but it does not make the chances of the patient any better to keep him covered against his will.

Some of the windows of the apartment should be kept open day and night, so as to have plenty of fresh air, unless the weather is damp and chilly, in which event a blazing wood-fire promotes ventilation and helps to make the apartment bright and cheerful. Draughts through the apartment are not amiss, but if stronger than a very gentle breeze they should not be allowed to fall directly on the body of the patient.

[1] The internal washing of the organism advocated by Dr. Sahli has substantially the same result as the hypodermoclysis of Dr. Cantani. The description of the method and apparatus employed is too long to be given here in detail. The intention is to secure the introduction of very large amounts of water into the cellular tissue under the skin, especially of the abdomen, by means of a canula connected with a rubber tube, which is connected with an elevated flask filled with the warm water which is to be so injected. It is stated that in this way as much as a quart of water can be introduced safely two or three times in the twenty-four hours.

It is taught by some authorities that the bed and clothing of the patient should never be changed from the beginning of the sickness until the convalescence is fully established. On the contrary, I hold that everything about him should be changed just as often as it gets soiled. Let him have the luxury of clean shirts and clean sheets. These changes can be made so as not materially to expose or fatigue the patient.

As a rule, the patient ought not to be allowed to get out of bed or to exert himself any way. This rule is not so important in the stage of effervescence as it is in the stage of defervescence; but it is better to be over-cautious than not cautious enough. Bed-pans should be used to receive the excretions from the bowels and kidneys, and even the drink and food should be administered in the recumbent or half-recumbent position. This is a wise rule in all severe cases, but during the dangerous days of defervescence it should be imperatively enforced; and if the patient needs to be moved in the bed, he should be lifted and turned like a child. So great is the debility of the heart in some cases that getting out of bed or sitting up in bed brings on fatal syncope.

It has been said of yellow fever that it is a disease that requires very little medication and a great deal of nursing; and certainly good nursing, day and night, without any intermission of careful attention, is of the utmost importance. Regularly educated nurses, when they can be had, are above all price. Usually, however, the nursing can be done by members of the family, whose solicitude will guarantee their faithfulness, or by intelligent friends who can be trusted to carry out the orders of the doctor. A great deal has been said about the importance of having nurses that understand the disease; but all that the nurse needs to understand is how to obey the instructions given him. The average volunteer nurses of our Southern cities, who swarm numerously whenever we have an epidemic of yellow fever, are unmitigated nuisances, and always to be avoided. A few of them make good nurses, but as a rule they are useless. In our Southern cities it is usually possible to get a sufficient number of colored women to do the nursing, and with a little instruction they frequently do very well. It is greatly in their favor that they are not likely to contract the fever.

It is always desirable in the very highest degree that the apartments in which the sick are treated should be situated in some part of the city or its suburbs that is free from the yellow-fever infection. This can frequently be arranged without any difficulty; and it makes a great deal of difference whether the patient during his sickness has to breathe the infected air of an infected house, or whether he breathes air that is free from infection. In great epidemics, when hospitals have to be provided

for many of the sick, they should always be placed out-side of the areas known to be infected, and if a hospital already in use becomes infected it should be promptly abandoned. Better treat the sick in tents in a pure atmosphere than in infected buildings. To many it will seem strange to talk of yellow-fever hospitals remaining free from infection. But such examples are not uncommon. Take two recent examples: In the great Florida epidemic of 1888 a large number of patients were treated at the Sand Hills Hospital, a few miles out of Jacksonville. The mortality was extremely small, and out of about twenty unacclimated attendants not a single one took the fever. During the same year thirty-five cases were treated at the Camp Perry Hospital, with only three deaths, and of five unacclimated attendants not one took the fever. The yellow-fever poison is a grovelling poison, of the earth earthy. It will not fly over a wall twenty feet high. It therefore follows that if the sick have to be treated in infected localities, it is better to put them in the upper stories of the houses than in the lower ones.

That the excretions of yellow-fever patients are contaminated with the yellow-fever poison has not been demonstrated, but it is strongly suspected. It is a dictate of prudence, therefore, that these excretions, whether from the stomach, the bowels, or the kidneys, should be subjected to the action of disinfectants. For this purpose the most approved agents are chloride of lime and carbolic acid. The chloride-of-lime solution is made by dissolving 6 ounces of the chloride in 1 gallon of water. The carbolic acid should be used in a 5 per cent. solution. These solutions should be employed very freely. From a pint to a quart should be mixed with each evacuation, and left in the vessel one hour for the chloride-of-lime solution, and four hours for the carbolic-acid solution, before throwing into the privy vault or water-closet. Quicklime should be freely used in privy sinks and upon all damp places in the yards.

The Use of Water.—Water is, in my judgment, the best of all febrifuges in yellow fever. It may be used both internally and externally, and its temperature may be varied to suit the prevailing indications. For internal use Dr. Simmons prefers to have the water ice cold, Dr. Ogier and Dr. Wall prefer warm drinks, and Dr. Thornton prefers the drinks to be either warm or only moderately cool. During the stage of effervescence I myself am in favor of a very liberal allowance of water in some palatable form, either pure water or some of the alkaline mineral waters, like seltzer or apollinaris, or some of the milder Saratoga waters, of which usually the mildly aperient properties are not objectionable. Bearing in mind the acid diathesis of the disease, acid drinks do not seem to be theoretically indicated; but if the patient expresses a preference for

acid drinks, they should be unhesitatingly allowed. As to the temperature of the drinking water, I prefer it to be just pleasantly cool, without being as cold as ice. I have known ice-cold water and crushed ice to be given in small amounts so frequently as to create an insatiable thirst, just as all of us have known children to provoke a similar condition of irrepressible thirst by eating snow. In the mean time, the higher the temperature of the patient the lower may be the temperature of the water allowed. If at any time the patient prefers to drink warm teas, his preference should be gratified, but not many such patients will be found.

As to the quantity of water that may be consumed with advantage, it is not possible to lay down any definite rule. I usually allow the patient about as much as he wants, taking care, however, that he shall take only a moderate amount at a single draught. Follow Nature. She is wiser through her instincts of craving and repulsion than the doctor is through the teachings of his science. If the patient craves a great deal of water, that craving is the surest of all indications that he needs a great deal. Water thus liberally used certainly exerts a considerable febrifuge influence. It promotes diuresis and diaphoresis. It cools the alimentary canal as far as it reaches it, and cools the hot blood into which it is absorbed. It soothes the perturbed nervous system and helps to keep the patient quiet. Shall we not also venture to hope that it has some power to wash out of the blood the terrible ptomaïne that causes so much trouble?

If the febrile reaction is very high, and if other methods of reducing the temperature have failed to accomplish that result, enemas of cold water frequently prove beneficial. They should be large—from one to three pints, and sometimes even more—should be introduced slowly and retained as long as possible, the retention giving time for the cooling process to go on, and also for the absorption of some part of the water. The temperature of the water used may be regulated by the pathological temperature to be combated—the hotter the patient the colder the water; but I think it should never be as cold as ice. These enemas, if they give relief to the patient, may be repeated as often as seems necessary. If they are not agreeable to the patient, they should be promptly abandoned.

By the common consent of yellow-fever experts water and watery fluids may be applied to the surface of the body in yellow fever, in the form of ablutions, affusions, and spongings, with very evident advantage. The face and hands may be washed as often as the patient finds it agreeable. The chest, and even the whole body, may be occasionally sponged over with either tepid or cold water, or compresses kept wet with cold water may be applied to the head or to the abdomen. Here, again, the rule applies that the temperature of the water may be

reduced just as the temperature of the patient is augmented. If the patient is very hot, it is not easy to hurt him with cold water.

In cases in which the temperature is extremely high and the neuralgias extremely painful the wet-sheet pack might be advantageously used. But yellow-fever patients require to be handled with great care, and the application of the wet pack is attended with some trouble; and I think the cases are not many in which it would be worth while to discuss the propriety of its use.

It is necessary to say a few words about the uses of ice in yellow fever. During the stage now under consideration I think the use of ice is hardly ever desirable, except to give to the water for external or internal application the proper temperature. But it may sometimes be demanded by the urgency of special symptoms, such as great heat or great cephalalgia. Usually, ice-cold water is better even in these cases than ice. If, however, it is decided to use the ice, it may be crushed into small pieces and enveloped in several folds of linen or cotton cloth. If intended for the head, a small towel is usually the best. If intended for the chest and abdomen, a small sheet will be found convenient. Or for either use it may be put into rubber bags impermeable to water. Although they afford great protection to the bedding and clothing, ice-bags are not always to be preferred to the towels and sheets. I think it is some advantage to have the compress wet the skin. In other words, the action of wet cold is often better than the action of dry cold.

The principles, just discussed, regulating the use of water and ice in the stage of effervescence, are applicable also to the stage of defervescence. But during the defervescence the natural demand for water is commonly less urgent than during the previous stage, and greater care must be exercised to prevent any excess in the use of it. The temperature of the patient is now usually much lower, and if enemas are to be given it is usually best to use warm water.

Other fluids besides water are frequently used for sponging either the whole body or some special part of it. Of these the principal ones are alcohol, vinegar, aromatic vinegar, aromatic gin, and Raspail's sedative water, all appropriately diluted. Sponging with these lotions may be done under cover and without worry or fatigue to the patient. Take a clean soft sponge or a soft piece of linen or cotton cloth, saturate it with the lotion, sponge carefully a small portion of the surface of the body, and then wipe it dry with a soft warm towel. Then go through the same process with another part of the surface, and so on until the whole body has been treated. This sponging may be repeated several times during the twenty-four hours if deemed advisable. The vinegar lotions are perhaps most commonly used. Lotions of alcohol, with or without admixture with water, are believed to have a specially

tonic effect on the relaxed skin. Raspail's sedative water has been a favorite with me.

In 1879, Mr. J. Livingston, a citizen of New Orleans, claimed to have discovered a specific cure for yellow fever in the thorough application to the surface of the body of a mixture of equal parts of water of ammonia and spirit of camphor. He had reached the conclusion that the poison of yellow fever is an acid poison, and he made use of the water of ammonia because he argued that by its alkaline property it would neutralize this acid poison, and for the further reason that by its property of rapid evaporation it would lower the febrile temperature. He went so far as to claim that it acted not simply on the surface to which it was applied, but that it penetrated through the pores of the skin into the blood itself. He states that after two applications of his mixture of ammonia-water and spirit of camphor, an hour apart, in actual cases, all the pains were permanently relieved, and that the fever subsided, never to rise again. I give this for whatever it may prove to be worth.

The Use of Food.—The regulation of the diet during the first stage of yellow fever is regarded by many practitioners as a very simple matter, it having been settled by the great majority of authorities that it is the safest and the best plan to give no food of any kind whatever; the only exceptions usually allowed being in the case of young children and in the case of persons greatly debilitated before the access of the fever. I have seen infants at the breast pass through attacks of yellow fever to prompt recovery, throwing up black vomit frequently and freely, and nursing as regularly and heartily as if there was nothing the matter with them. The safety-valve in these cases was the continued activity of the kidneys. In spite, however, of the general consensus of opinion in regard to this problem, I am not satisfied that it is the best policy to deny food to yellow-fever patients, even during the stage of febrile effervescence.

Yellow fever is a profoundly adynamic disease. This is shown by the feeble heart and by the great exhaustion that follows any considerable exertion. The flux of blood from the stomach and other organs, and the flux of albumin from the kidneys, are terrible drains on the strength of the patient. It is true that these fluxes do not play a prominent part in the first stage of the fever; but it would seem to be the dictate of wise foresight to anticipate their advent, and to fortify the organism in advance as much as possible, so as to make it strong to resist their encroachments when they do make their appearance. I do not forget that the stomach is not always in a condition to receive and digest food; but, on the other hand, it is often able to do a reasonable amount of this sort of work, and advantage may be taken of such opportunities as present themselves to look after the patient's nourishment.

During the stage of defervescence the strength of the patient must be economized and fostered in every available way. At the beginning of this stage, during the period of calm, there is apt to be a revival of the appetite, and it may become importunate. This importunity is to be partly resisted and partly gratified. In other words, food must be given, but it must be given with much care, so as not to tax too heavily the debilitated stomach. As the stomach shows more and more tolerance for food, it may be given more and more freely; but it is not to be forgotten that a fit of indigestion and emesis might turn the scales the wrong way and precipitate a fatal termination of the case.

There can be no question as to what constitutes the most appropriate diet. Milk, pure, fresh, sweet milk, is better relished, agrees better with the debilitated stomach, and is easier of assimilation than anything else. It is Nature's favorite food for all the species of the great family of mammals to which man belongs. Fresh buttermilk has not been much used in yellow fever, but where it is well relished by the patient and well borne by the stomach it would probably make an admirable article of diet.

It is best to suit the temperature of the milk to the appetite of the patient. It will usually be preferred pleasantly cool. It may be given without any sort of admixture; but if there is much gastric acidity, it may be mixed with lime-water, or alternately with a solution of sodium bicarbonate. Given cool and in considerable quantities, it will largely take the place of other beverages—it is drink as well as food. If the digestion is much impaired, peptonized milk might be given. Milk is, indeed, the ideal food in yellow fever. It is pleasant to take, it is nourishing, it is easily digested, and it is believed to exert some favorable influence over the kidneys. As is well known, it is the favorite diet in Bright's disease.

Other available articles of diet are meat-juice and beef peptonoids. Duero's elixir has been favorably mentioned. Warm chicken broth is sometimes specially palatable, and the preferences of the appetite are always to be consulted and respected. When food is relished and easily digested, it is certain to do good, but care must be taken not to tax the digestive organs beyond their capacity; and any feeling of gastric fulness or discomfort is an indication that is not to be disregarded. No solid food is ever to be allowed until all danger is over.

THE TREATMENT OF THE TYPICAL FORM.

In yellow fever it is in the typical form alone that any considerable field is found for the application of the resources of practical therapeutics, and it is accordingly in connection with this form that most of the problems involved in the treatment of this disease will be discussed.

The Stage of Efflorescence.—This stage, as already explained, ends

usually on the fourth day. It includes the chill which is so common at the outset, and is followed by the calm which introduces the next stage.

The peculiarity of the chill in yellow fever is that it often occurs in the night and at any hour of the night, very often after midnight. It may, however, occur at any hour during the daytime. This is in contrast with malarial chills, which occur most frequently in the morning. In some cases the chill is hardly perceptible, and it is usually brief and of only moderate severity. Occasionally it is protracted to considerable length, with imperfect reaction and alternate shiverings and flashes of heat. It is very rarely that the patient is seen by the physician during the chill, and hence the chill seldom receives treatment. In the mean time, however, it is the universal custom amongst the people of the Southern States to treat the chill promptly with a hot mustard foot-bath. The patient is placed in a chair with his feet in a tub of water as hot as he can bear it, and in which mustard has been liberally mixed. The patient, the chair, and the tub are enveloped in a large blanket gathered closely about the neck and falling down to the floor, and the feet and legs up to the knees are briskly rubbed by an attendant. The hot water to the feet and legs, and the hot vapor that encompasses the patient's body under the blanket, soon provoke copious perspiration, which is sometimes still further encouraged by the administration of some hot tea, usually orange-leaf tea, or some hot lemonade. When the chill passes off, which it usually does very promptly, the patient, already in a hot fever and wet with sweat, is wiped off with dry towels, and put to bed and covered with blankets. Here the sweat is maintained by abundant covering and an occasional draught of some hot drink; and in this condition he is usually found by the physician on his first visit.

In Havana this custom of the universal hot foot-bath does not obtain. It is spoken of favorably by a few of my correspondents, but is dismissed by the majority of them as of no consequence. It is doubtless true that in the larger number of cases the hot foot-bath and the hot drinks are not of any special value. At the same time, it can hardly be charged that in any class of cases they are productive of positive harm; and it would seem that their influence might be beneficial in cases in which the chill is severe, or in cases in which the reaction is delayed, or in cases in which there is considerable pain in the head and back, due presumably to cerebro-spinal congestion.

It is not desirable that the free perspiration thus established shall be suddenly checked. While excessive perspiration is not to be encouraged, it is desirable that the skin shall be kept soft and moist. The evaporation of the surface moisture must to some extent reduce the superficial heat. Nevertheless, the hot skin remains hot and the perspiration is in no way critical.

After the chill there is very rarely further occasion for the use of the hot pediluvium and the hot drinks. But if the feet should get cold, or if the cerebral and lumbar pains are intense, or if the skin should become obstinately hot and dry, some authorities hold that it is good practice to repeat this treatment even more than once, only on these subsequent occasions the patient is not moved from his bed to receive it. My own opinion is that under the conditions mentioned cold sponging of the body and cold compresses to the head are more pleasant to the patient, and at the same time more efficacious. In some cases cold applications may be made to the head, and at the same time hot applications to the feet.

The next question for consideration is whether or not to give a preliminary emetic. The abstract propriety of this is usually admitted by Southern physicians in cases where there is a furred tongue or a torpid liver or a stomach overloaded with undigested food. Nevertheless, in actual practice amongst us emetics are not often administered. In Havana the preliminary emetic is much more common, and it is hardly ever omitted by those physicians who have become thorough advocates of the eliminative treatment. Ipecacuanha is the emetic usually preferred, 40 grains in two powders given with ten to twenty minutes between them, with some hot beverage to facilitate the emesis.

If a great many yellow-fever physicians fail to give the preliminary emetic, none of them fail to give the preliminary purgative. If an emetic has been given, it is necessary to wait a few hours, from three to six, until the gastric irritation and nausea have subsided; but some practitioners give the emetic the first day and the purgative on the second. When no emetic is prescribed, the purgative is given as promptly as possible, sometimes before the subsidence of the chill if the case is seen so soon as that. It is held by all authorities that the purgative should be of such character as to act speedily and thoroughly, so as to sweep from the alimentary canal all the materials within it. The purgative action having been obtained, it is almost the universal custom in the South not to give any more purgative medicine during the entire subsequent progress of the fever, unless there is some clear indication for doing so (Drs. Ogier, Simmons, Thornton, Wall). In Havana the advocates of the eliminative treatment sometimes continue the daily administration of purgatives for several days. Some of them, however, content themselves with the daily administration of enemas.

In the Southern States a mercurial purgative is generally preferred, either calomel alone in doses of from 10 to 30 grains, or calomel in combination with some vegetable cathartic. It was formerly a very common practice in Mobile and Charleston and other Southern cities to use the combination of calomel and quinine recommended by

Blair, who employed it in British Guiana in 1851–53—namely, 20 grains of calomel and 24 grains of quinine at a single dose. By Blair this dose was often repeated, and even more than once. But in this respect his example has not been much followed in the South. Dr. Simmons still prefers this combination for the preliminary purgative. Dr. Ogier uses the following combination: Take of calomel 10 grains; of resin of podophyllum, ½ grain; of pulverized ipecac, ¼ grain; of extract of hyoscyamus, 3 grains. Mix and take at one dose in a capsule.

Dr. Thornton prefers a mercurial purgative, but mentions no special combination. If the mercurial purgative fails to act in about six hours, it is assisted by a dose of castor oil or a dose of some saline or by an enema.

Next to such mercurials as have been indicated, the most popular preliminary purgative is castor oil, sometimes in very large doses, as much as 4 fluidounces, and at other times in very small doses, as ½ ounce only. Comparatively large doses of castor oil act more efficiently and more pleasantly than very small doses, and there is very little danger of hypercatharsis from it. At the same time, a dose of 2 ounces is sufficient for most cases, and 1 ounce usually acts well.

Saline purgatives are very frequently used, although it has been urged that in their cathartic effects they are too unmanageable to be generally adopted. Magnesium citrate and sodium sulphate are the salines most commonly selected.

In my own opinion it is really a matter of very little importance what purgative is employed, provided sufficient doses are given to secure thorough evacuation of the bowels.

In Havana it is a very common practice to repeat the purgatives from day to day, so as to secure daily evacuations of the bowels. In favor of this practice two arguments have been urged: (1) That in this way, to a considerable extent, the hypothetical yellow-fever germs, along with the pathogenic ptomaïnes which they generate, are swept out of the body, and the absorption into the circulation of these ptomaïnes measurably prevented. (2) That in this way, to a considerable extent, we secure the depuration of the blood from the accumulated products of the retrograde metamorphosis of the albuminoid tissues, which depuration is normally performed by the liver and the kidneys, now so crippled as not to be able to do this work efficiently. These arguments are very plausible, but I am not aware of the existence of any conclusive clinical proof of the advantages to be derived from copious and repeated purgings. As a rule, I like to see the bowels act moderately every day or every second day, but I would use only the mildest means to secure this result.

The chill passes rapidly. Just as rapidly comes the fever. Almost at a single bound the temperature and the pulse—the witnesses and the exponents of the fever—reach their highest elevation; and then very soon, in a large majority of cases, they begin to decline. The average of highest temperatures is below 104° Fahr. The temperature-ranges furnish very valuable prognostic indications. If the highest temperature reaches 105° or more, the patient is almost certain to die. Any temperature between 104° and 105° shows that the patient is in very great danger, the mortality-rate in such cases being about 50 per cent. Between 103° and 104° the mortality-rate is about 25 per cent. When the highest temperature is below 103°, nearly all of the cases recover.

Since high temperatures foreshadow such unfortunate results, the inclination to employ antipyretic agents in the treatment of this malady is a very natural one. In the mean time, however, it must be remembered that it is not the heat that kills the patient; and, on the other hand, it is safe to assume that the high temperatures and the fatal terminations are dependent on common causes, amongst which the most important are perhaps the pathological lesions in the vaso-motor and great sympathetic nerve-centres. If by the abstraction of heat from the body we could restore to their physiological integrity the organs engaged in its production, then the antipyretic treatment would be specific, and yellow fever would be robbed of its terrors. But the treatment by the use of antipyretic drugs has not been attended with any marked success. It is possible in this way to reduce the temperature, but to accomplish this very large doses of these remedies are required, and the antipyretic effects obtained are not lasting. If any advantage is gained by the temporary amelioration of the febrile heat, it is more than counterbalanced by the injury inflicted on the nervous system.

Notwithstanding these considerations in regard to antipyretics, there are skilful practitioners who in this stage of the fever employ febrifuge mixtures—not in large antipyretic doses with the intention of jugulating the fever, but under the belief that in moderate amounts they influence favorably the progress of the case. Dr. Ogier recommends an aconite mixture, as follows:

R.	Tr. aconiti,	f℥ss;
	Olei sassafras.,	♏vj;
	Syrup. lactucarium (Aubergier),	f℥ss;
	Aquæ destillat.,	f℥ij.—M.

Sig. A tea-spoonful every two hours.

Dr. Simmons recommends mild neutral or alkaline diaphoretics, as follows:

℞. Potassii citratis, ʒij;
Potassii chloratis, ʒijss;
Spirit. æther. nitros., f℥j;
Aq. camphoræ, f℥vj.—M.
Sig. A dessert-spoonful every two or three hours.

℞. Sodii sulphitis, ʒij;
Spirit. æther. nitros., f℥ss;
Liquor. ammonii acetatis, f℥iij;
Aq. destillat., f℥ij.—M.
Sig. A table-spoonful every two or three hours.

Dr. Wall prefers antipyrine.

Of late years the alkaline and antiseptic mixture, of which the formula is given in the communication of Dr. Burgess, has to a large extent taken the place of such febrifuges as those mentioned above. It was first used in Havana in 1888, and in that same year was also used in Alabama and Florida. The dose of this mixture is 1½ ounces, and it is given ice cold. In Mercedes Hospital the rule to give the medicine every hour is so rigorously construed that if the patient is asleep when the time comes he is awakened to take it. When it is used it nearly crowds out all other medicines, and, as the amount of water in it is considerable, it often happens that but little additional water is needed.

The theory of its action is that the mercury bichloride destroys in the stomach and duodenum the germs which produce the disease, while the sodium bicarbonate neutralizes the acid condition of the system. It is further affirmed by those who have used it that it acts as an efficient diuretic, and that it exercises a notable influence in the prevention of albuminuria. It is also stated that it acts as a laxative on the bowels, sometimes even causing diarrhœa; which is an indication that it is not absorbed and calls for its temporary suspension. If this medicine even approximately fulfils the claims that have been made for it in the treatment of yellow fever, it will be hard to estimate it too highly. In the mean time, one word in regard to the acid diathesis in yellow fever, and another in regard to the germicidal theory of treatment.

(1) The fluids of the stomach are naturally acid, and so is the urine; but these fluids become more intensely acid as the disease progresses. Normally, the contents of the bowels have an alkaline reaction, and they remain alkaline in yellow fever until the disease is considerably advanced, and usually until the acid black vomit, instead of being thrown up, passes down into the bowels. In advanced stages

of very severe cases it is stated that the blood also becomes acid. The acid diathesis, then, is not present at the beginning of the attack, and becomes fully established only in the stage of defervescence. It is doubtless wise, however, to anticipate the acid period by the administration of alkalies with a view to its prevention.

(2) Admitting that the germs which generate the ptomaïne which generates the disease can be reached in the stomach or in other parts of the alimentary canal by germicides sufficiently powerful for their destruction, still, it does not follow that the germicidal treatment would have all the advantages we are at first thought inclined to ascribe to it. I think it is almost certain that, in spite of any possible slaughter of germs, the disease, once established, will run on through all of its regular stages until the susceptibility of the system is exhausted; that is to say, until the period of immunity is reached. I do not mean to maintain that germicidal remedies may not be useful in yellow fever, but only that we cannot expect them to jugulate the disease. The yellow-fever germs are probably destroyed in the system before the end of the stage of effervescence—poisoned either by the products of their own malignant energy or else unable to withstand the acid diathesis which they have indirectly established.

During the febrile commotion of this first stage of yellow fever there is very often an evolution of intense cephalalgias and rachalgias, and sundry other irritations and discomforts. These very often yield to the affusions and lotions and cold compresses already described. But sometimes they continue troublesome after these remedies have been faithfully employed, and it then becomes necessary, or seems at least to be expedient, to invoke the assistance of analgesics and nervous sedatives. Of this class of remedies antipyrine seems to have given the best results. It is administered in doses of from 5 to 15 grains, and repeated as the occasion seems to require. It can usually be given by the mouth, but may also be given in larger doses by enema.

Opium and morphine were once freely used in yellow fever, but of late years they are hardly mentioned in connection with it, except as prohibited drugs. They may produce nausea; they may check the secretions, especially that of the kidneys; and there is no doubt that if unskilfully used they are dangerous remedies. Nevertheless, there is an occasional case in which they seem to be demanded, in which they bring relief when all other medicines have failed to do so. In this connection I cannot do better than to quote the words of one of my correspondents, Dr. Thornton: "Opiates, in my judgment, are demanded when muscular pain is so intense and continuous as to prevent rest and sleep, and when other sedatives have failed to bring relief. I was utterly opposed to the use of opiates until I experienced the benefit afforded by one dose of morphine in my own person—the

fourth or the third of a grain—after I had been suffering day and night for forty-eight hours. The pains in my back and legs and other parts of my body were so intense that I told my physician that I must have relief even if it resulted in my death. Late one night he gave me the dose mentioned in a solution of hyoscyamus. It brought exemption from pain, and it brought sleep, the most refreshing sleep I had had during my illness. This experience changed my mind in regard to the administration of opiates in yellow fever. Of course the best judgment of the physician must be exercised on this important point; but I am confident that writers on the treatment of yellow fever have ignored or condemned this drug too much. At the same time I am well aware of the dangers that attend its abuse."

Vomiting is not usually a distressing symptom in this stage of the fever, and when it is so it is not usually a dangerous symptom. Nevertheless, it always excites apprehension that it may lead on to the dreaded black vomit, and active steps are deemed necessary to arrest it. Copious draughts of hot water until the stomach is thoroughly washed out are usually sufficient to bring relief; and this procedure may be subsequently aided by cold compresses to the epigastrium, or Rivière's potion may be tried.

The Stage of Defervescence.—Just as the chill is the introduction to the stage of effervescence, so is the calm the introduction to the stage of defervescence. It is sometimes so little marked as not to attract special attention; sometimes it is of very brief duration, lasting only an hour or two; and sometimes it is protracted to twelve hours or more. It is one of the most notable features in the evolution of a case of yellow fever, and is in striking contrast with the stormy manifestations which have preceded it. In the milder cases it is the immediate prelude of convalescence, but in most cases of the typical form it is simply the beginning of the stage of defervescence, which runs through a course of from three to six days. While the calm lasts but little is necessary in the way of treatment. The patient must be kept in bed. Sternberg's mixture may be continued, or, as Dr. Wall phrases it, we may pursue a course of masterly inactivity, waiting to see which way the scales will turn. At this time the patient's appetite is apt to revive, and it may become importunate. But under no circumstances must any solid food be allowed. Nothing but milk is admissible, and care must be taken to give this in small quantities at a time, so as not to tax too heavily the debilitated stomach. If the stomach shows sufficient tolerance for it, it may then be given more freely. Some prefer to combine lime-water with the milk. If this is done, Sternberg's mixture may be discontinued. The period of calm is sometimes characterized as a period of remission. There is, indeed, a remission in the urgency of many of the symptoms, but it

is not, in any proper sense of the words, a period of febrile remission. True, the pulse has now fallen down into the neighborhood of 80, and the temperature is perhaps down to 102°, or even lower. But, however severe the subsequent course of the attack may prove to be, neither the pulse nor the temperature are likely to rise again. On the contrary, their tendency is to decline more and more to the end, whether the end be in recovery or in death, although in a few cases just before the fatal termination there may be a sharp and sudden acceleration of the pulse-rate.

The stage of defervescence is the stage of danger and of dangerous complications—of suppression of the urine, of hæmorrhages and black vomit, of heart failure and yellow discoloration, and the stage in which death claims so many victims. It therefore requires the most assiduous and skilful medical management.

In severe cases the acid diathesis is now fully established—if not at the beginning of this stage, at any rate before the end of it—and the propriety of alkaline drinks is hence very manifest. The natural alkaline waters may be sufficient to meet the indications, or sodium bicarbonate may be given in large dilution to the extent of 30, 60, or 120 grains in the twenty-four hours. Our hope is that this alkaline treatment may to some extent ward off the mischievous influences of the acid diathesis on the blood and the glandular organs, and especially that it may prevent or lessen the dreaded pathological changes to which the kidneys are so extremely liable. We continue the alkaline treatment throughout this stage of the disease, or as long as the condition of the patient remains precarious, or unless the occurrence of diarrhœa demands its temporary or permanent suspension.

The strength of the patient must be sustained in all possible ways. If the heart shows signs of debility, and especially if a very feeble pulse and sighing respiration come together, we must resort to the systematic use of alcoholic beverages. They should be made into pleasant combinations, and while their effect is to be carefully watched, if they are really needed and are well tolerated they should be given in sufficient quantity to get from them some appreciable influence. If they should prove disagreeable to the patient, or if any bad symptoms can be traced to their administration, they must be discontinued. Good French brandy is one of the best of these beverages, but I more commonly select good whiskey, because it is much more easily obtained. Wines, especially dry wines, when they suit the patient's taste, are not objectionable; but, as a rule, Americans are not partial to wine. Champagne has been generally lauded amongst us, especially when the symptoms herald the approach of black vomit or after the black vomit has made its appearance. It suits some cases admirably, and is relished above all other drinks; but I think its high reputation has

not been altogether merited. It may be given in small quantities ice cold, or frozen champagne (champagne frappé) may be used in teaspoonful doses frequently repeated. Care should be taken that the champagne is dry and of good quality. The cheap champagne that is often sent by charitable people to communities stricken with yellow fever is worse than useless. It has occurred to me that wine of coca might sometimes be useful, but I have had no experience with it. If stimulants are needed at all in yellow fever, I believe that alcoholic stimulants are to be preferred to all others. They are usually pleasanter to take, and their influence is more stable and lasting. They are more or less antidotal to many poisons. For example, they are the best remedies we have for snake-bites and for the cadaveric infection received through dissection-wounds. In the mean time, it is not to be forgotten that the majority of Havana physicians do not accord to alcoholic beverages a very prominent place in the treatment of yellow fever. I may mention here again the combination of cognac, coffee, and coca recommended by Drs. La Guarda and Martinez. When the need of stimulants is very urgent, and the stomach refuses to tolerate them, they may be administered by enema or hypodermically.

During this stage great advantage may often be obtained by the judicious use of the lotions, affusions, and compresses already mentioned in connection with the treatment of the preceding stage—aromatic vinegar, aromatic gin, Raspail's sedative water, etc.

If we can guide the patient through this stage, so as to avoid its dangers on each day, we are fortunate. But if the dangers come in spite of all our skill, what then? If the liver fills up with fat and ceases to perform its depurative functions, ceases to construct urea and bile and glycogen out of the products of retrograde metamorphosis; if the blood becomes loaded with effete materials, and the red corpuscles begin to lose their hæmaglobin, and all the tissues turn yellow; if the dark, grumous blood begins to ooze from the mouth and the nose, and in women from the uterine cavity; if the stomach begins to utter complaints in sensations of intolerable oppression, weight, and burning, and the white vomit, and then the terrible black vomit, make their appearance; and if the urine becomes scanty and more scanty from day to day, and heavily loaded with albumin;—if these things come to pass, what then? The outlook then becomes gloomy indeed, but we must do the best we can. Not many of these cases recover, but a few of them struggle back to the bright precincts of the cheerful day. With all this turmoil of symptoms of bad omen, as long as the kidneys secrete a reasonable amount of urine, even if it does contain an abundance of albumin, the case is not absolutely desperate. It is not the white hæmorrhage of the albumin in the urine that kills the patient, any more than it is the black hæmorrhage of the black vomit that kills

him. But after the complete suppression of the urine I have never known a single case to recover. With the stoppage of the urinary secretion there is doubtless such a stoppage of the depuration of the blood as is incompatible with the continued vitality of the organism. The organic functions are suspended, not simply because the organs have quit work, but because they are suffering from such extensive lesions that they are no longer able to work; and no stimulus known to our therapeutics can lash them again into even temporary activity. If we could only gain a little time, if we could only keep the patient alive for a few days, then all would come round right, the strangest of all the strange things about this strange malady being the wonderful facility with which these crippled organs recover their physiological integrity and resume their wonted functions when the pathological processes have spent their malignant energy.

The treatment for the prevention of black vomit begins as soon as the preliminary symptoms are observed. To relieve the gastric distress we may give bits of crushed ice or of champagne frappé, and apply ice-bags or crushed ice folded in a sheet to the epigastrium. I have kept crushed ice to the epigastrium for sixty consecutive hours, and have been rewarded by the recovery of my patient after copious black vomit, not accompanied by suppression of urine. There is one rule that is never to be forgotten in regard to this treatment. If the ice is not agreeable to the patient, its application should not be continued. I do not know that large draughts of very hot water have ever been tried for black vomit. It has a good effect in some other hæmorrhages. What effect it would have in the gastric hæmorrhage of yellow fever can only be conjectured. Of course it would be promptly thrown up again, and for this reason most yellow-fever doctors would hesitate to give it. But I am satisfied that the mere act of emesis does not do the patient any great damage, and I am also satisfied that the gastric hæmorrhage is not sufficient in amount in most cases to determine the fatal result. I have already stated that if the kidneys are not too badly crippled, black-vomit cases may recover. It is only as the most prominent exponent of the general condition that black vomit has won such a dreadful reputation as the precursor and harbinger of dissolution.

It has been common when the gastric trouble begins to apply blisters to the epigastrium. They are recommended by Dr. Ogier, Dr. Simmons, and Dr. Thornton, and are mentioned with some favor by several of my Havana correspondents. Nevertheless, I must be allowed to say that I have never seen them do any good. Dr. Ogier recommends that the whole chest and abdomen shall be rubbed with a strong croton-oil liniment or covered with a thapsia plaster for eight or ten hours until a rash appears on the skin, when generally, he says,

all urgent symptoms disappear. Ergot has been found so efficient as a hæmostatic agent that it has been freely used to check the hæmorrhages of yellow fever, especially the black vomit. This drug acts by causing contraction of the capillary blood-vessels; but in yellow fever the lesions of the vaso motor nerve-centres and the lesions of the capillary vessels themselves are of such a grave character that in many cases the ergot produces very little effect. It may be used, however, in default of anything better, and when used should be given in decided doses, say from 40 to 60 drops of a good fluid extract; and it is usually best to give it by hypodermic injection.

The great problem in the treatment of yellow fever is how to relieve the embarrassed kidneys. Even the gastric trouble, of which we have just spoken, is but a consequence of this. Says Dr. Wall: "I look upon the gastric trouble in the beginning as only a symptom of the nephritic inflammation, being also a marked symptom in acute nephritis of idiopathic origin. The hæmorrhages, black vomit, etc. are the results of changes in the blood, produced by the retention of excrementitious matters which the diseased kidneys have failed to eliminate." When the urine begins to diminish in quantity and the albumin to increase, we begin to think about the administration of diuretics, but it is doubtful if they ever do any good. The kidneys are already in a state of hyperæmia, and the diminished excretion of urine is due to destructive lesions of the secretory apparatus. The application of inunctions and frictions and dry cups and turpentine stupes to the lumbar region may be tried, and the colon might be flushed with very large enemas of hot water, with the hope of relieving the condition of the kidneys.

The Stage of Convalescence.—Convalescence in yellow fever is usually rapid. Indeed, it is usually so rapid as to provoke surprise when we remember the number and the gravity of the pathological lesions which characterize the disease. The emaciation is usually not great, and there is an abundant store of fat to supply fuel to keep up the animal heat. The kidneys in a few days resume their normal functions, and secrete urine in normal quantity and free from albumin; and dropsy is not among the sequels of yellow fever. The liver seems very soon to disembarrass itself of its load of fat, and promptly begins the depuration of the blood by the making of bile and urea. Occasionally, however, the jaundice is intense and clings to the patient for several weeks. The functions of the great sympathetic nerve-centres regain their physiological integrity more slowly, and the temperature and pulse continue subnormal, sometimes for weeks, especially the pulse. The appetite is promptly re-established, and sometimes becomes importunate. During the earlier days of the convalescence all importunities of the appetite must be firmly resisted, because a little imprudence

may bring on indigestion, and indigestion may provoke vomiting and relapse; and relapses in yellow fever are very dangerous, in many cases fatal. For two or three days all solid food must be prohibited. Milk is still the best food, and may be taken frequently in moderate quantities. If meat-broths suit the appetite better, they are not objectionable. As soon as the convalescence is fairly established soft-boiled eggs may be allowed, and then tender meats, and a little later fruits and vegetables, with crackers and toasted bread.

THE TREATMENT OF THE MILD FORM.

The mild form of yellow fever requires no special medical treatment. It will get well with any sort of treatment or with no treatment at all. We cannot always tell at the beginning what cases are going to be mild. We may therefore give a preliminary purgative, followed by some alkaline drinks or by Sternberg's mixture, and watch the developments. If the chill is short and slight; if the pulse is not more than a few beats above one hundred to the minute; if the highest temperature is below 103° Fahr.; if the pains in the back and head are not distressing; if the face and the eyes retain their natural expression; if all of the secretory and excretory functions of the body seem to be in good condition:— in a word, if all the symptoms are of mild character during the first day, and especially if they so continue during the second day, we may conclude that the patient is in no danger, and we may content ourselves with a milk diet for a few days, and with proper attention to the patient's environment.

How are we to know that these mild cases are cases of yellow fever? Positive diagnosis is difficult. But if they occur in the midst of a yellow-fever epidemic; if the patients have been exposed to yellow-fever infection; if the fever, however slight, is a fever of one paroxysm; if there is any manifest want of parallelism between the pulse and the temperature,—all these facts are suggestive of yellow fever. If there is a trace of albumin in the urine on the third day, the evidence becomes conclusive.

But is there such a thing as yellow fever without albumin in the urine? I myself have not seen many very mild cases of yellow fever, and I have never seen a case that I regarded as yellow fever in which the albuminuric complication was not found if it was sufficiently sought for. Still, I am not prepared to say that there are no such cases. Dr. Wall tells us that such non-albuminuric cases were not uncommon, according to his experience, in the Tampa epidemic of 1887. I can only remark in passing that the epidemic of 1887–88 in Florida was the mildest in our whole yellow-fever history. In the mean time, we have seen Drs. Finlay and Delgado, with their long experience in Havana, tabulating their first form of the fever as non-albuminuric,

characterized by the absence of albumin during the whole course of the disease, or by its appearance only in insignificant amount. If such cases occur, they are practically of little importance unless they should happen to be the first cases in a community in which no yellow fever was known to exist; and I have my doubts whether even then they would generate sufficient poison to inaugurate an epidemic.

I think it probable that albumin is not discovered in the urine sometimes in mild cases of yellow fever because the tests are not carefully applied. Dr. Guiteras tells us that in his Florida experience, during the same epidemic of which Dr. Wall writes, he always found albumin, and frequently on the second day. He used Heller's test.

THE TREATMENT OF THE MALIGNANT FORM.

In the malignant form of yellow fever all treatment is found to be unavailing and impotent. The vital energies are overwhelmed from the beginning of the attack. There is a sudden invasion by the fever, with or without severe chill, with intense pain in the head and eyeballs, accompanied by sickness and vomiting. Sometimes the fever is ushered in by convulsions or apoplectic stupor or outrageous delirium. The whole appearance is ghastly, and there is a faint nauseous odor from the body. The skin becomes rapidly yellow, and then bronzed or mottled by ecchymotic effusions of blood, and at the same time so torpid as to be insensible to the stimulation of blisters and sinapisms. The conjunctivæ become intensely yellow, and the conjunctival veins turgid with blood, and the face becomes swollen and discolored like that of a man after a long debauch. The stomach becomes greatly distressed, with eructations or explosions of flatus, and black vomit rapidly supervenes, together with black, watery, shreddy stools. Hæmorrhages are common from the natural outlets or into the connective tissue beneath the skin or amongst the muscles. And, finally, death comes mercifully to end the terrible struggle—most usually on the third or fourth day, but sometimes before the expiration of the first day.

Leading Indications for the Treatment of Yellow Fever.

In arranging a theoretical basis upon which to formulate a plan for the treatment of yellow fever, it is important to take into account the leading indications furnished by the clinical history of the disease. I have endeavored to express these indications compendiously in the subjoined propositions:

(1) Yellow fever is a specific fever. It is caused by the pathogenic action on the human organism of a specific poison, which is probably a ptomaïne or a toxalbumin generated by a specific germ or microbe—bacterium or bacillus. Both the yellow-fever poison and the microbe which generates it have up to this time escaped scientific demonstration.

But we postulate the microbe because it is certain that with the concurrence of favorable conditions the poison is rapidly multiplied and increased, and this necessarily pre-supposes the agency of a living organism. And we postulate the ptomaïne because, in regard to its propagation in space and time, and in regard to its genesis and evolution in individual patients, yellow fever is strictly analogous to other specific fevers which are known to be produced by germ-generated ptomaïnes, and because, indeed, all pathogenic microbes are pathogenic only through the agency of the pathogenic ptomaïnes. It is commonly believed that the yellow-fever microbe finds its favorite habitat somewhere within the human organism—that within that habitat it feeds and grows and multiplies its generations, and there in the processes of its growth and reproduction elaborates the deadly yellow-fever ptomaïne. Accepting this hypothesis, it is easy to see that the treatment of yellow fever would be easy if our materia medica afforded agents competent to destroy the yellow-fever microbes within the organism, to neutralize the ptomaïne within the organism, or to eliminate the microbe or the ptomaïne, either or both, from the organism. Unfortunately, however, we have no such therapeutic agents, and we must treat the patient instead of the microbe or the ptomaïne. We have a large number of specific fevers, and it is a remarkable fact that not a single one of them is amenable to specific treatment, unless we make an exception in regard to quinine in the treatment of the malarial fevers; and this is probably not a genuine exception.

(2) Yellow fever, like all other specific fevers, runs a specific course, and is characterized by a specific symptomatology and a specific concourse of pathological lesions. It cannot be aborted in its initial stages; it cannot be cut short at any period of its evolution. It subsides only when the period of immunity is reached, and when the patient is no longer susceptible to the pathogenic influence of the producing poison. The cause of this immunity we do not know, but it is a very remarkable and a very beneficent concomitant of all the specific fevers. If the patient reaches the period of immunity before the vital organs have suffered some mortal injury, he recovers, and the convalescence is usually rapid. If the mortal injury comes before the exhaustion of susceptibility, the patient dies. In the treatment of yellow fever it is the office of the wise and skilful physician to guide the patient with all possible care through the multiform and multitudinous dangers that encompass the road he has to travel, and every rational method of treatment under such conditions must of necessity be to a large degree expectant and symptomatic.

(3) Yellow fever is a fever of profoundly adynamic type, with lethargy and torpor and debility of all the tissues and organs of the suffering body. In the more malignant cases the functions that resist

death and all the vital energies of the patient are in a few days overwhelmed and annihilated. In less severe cases the adynamic tendency constitutes one of the remarkable characteristics of the malady. Even in the mildest cases this adynamic tendency is discoverable; and in the treatment of this fever, therefore, all depressing and powerfully perturbative remedies are to be avoided, and assiduous care must be exercised to conserve and sustain the vital energies of the patient.

(4) The depressing and sedative influence of the poison shows itself prominently in the course of the temperature, which frequently reaches its highest point within a few hours after the beginning of the attack, which in an immense majority of the cases reaches its highest point before the end of the first day, and in which the thermometric maximum is rarely delayed until the third day. This maximum once reached, the tendency of the temperature is to decline steadily and day by day until it reaches or falls below the normal thermometric degree. Aside from the daily morning and evening perturbations, which are less marked than in most other fevers, there is never a second rise of fever, unless it is caused by some intercurrent inflammation or other intercurrent cause. This natural tendency toward defervescence is not to be forgotten in discussing the propriety of administering antipyretic drugs.

(5) The depressing and sedative influence of the yellow-fever poison shows itself still more notably in the course of the pulse, which invariably reaches its maximum in a few hours after the beginning of the attack, and then declines steadily until it reaches the normal frequency, or, as is still more frequently the case, until it falls considerably below the normal even in cases that recover. This abnormally slow pulse often continues for several days, and sometimes for weeks, after the establishment of convalescence. Sometimes shortly before the termination of fatal cases some intercurrent complication may occasion a second rise of the pulse, and this without any recrudescence of the febrile temperature. The pulse is not only slow, but it is also wanting in force and tension, and in malignant cases assumes a gaseous character, as if the arteries were filled with air instead of blood. The indications of treatment furnished by the pulse suggest the administration of restoratives, tonics, and stimulants, and that arterial sedatives should be used only in exceptional cases, and with great caution if they are used at all.

(6) Yellow fever is not in any decided way an inflammatory disease, although intercurrent inflammation, internal or external, may enter as a complicating factor in some cases. Inflammations of internal organs may be attended with considerable danger. The danger from inflammations of external organs is much less. In uncomplicated yellow fever, therefore, antiphlogistic treatment is contraindicated.

(7) While yellow fever is not characterized by the active and massive congestions so common in the malarial fevers, nevertheless capillary congestion or hyperæmia or blood-stasis of a passive kind is one of the most remarkable features of its pathology. This hyperæmia is to be observed in the capillary vessels of the skin and of the mucous-membrane, and in the brain and the kidneys. It is due to the debility of the heart, which no longer drives the blood through the arteries with its accustomed energy; to the want of elasticity and resiliency in the arterial tunics; and to the fatty degeneration of the epithelium lining the capillaries, which gives rise to numerous infarctions and ecchymoses. We know of no treatment which has the power to relieve these passive hyperæmias. Such relief, indeed, could be found only in the restoration of the vital energy of the heart and in the re-establishment of the contractility and elasticity of the arterial tunics. In the mean time, the energetic and revulsive treatment found to be useful in malarial congestions has not been found admissible in yellow fever.

(8) In malignant yellow fever there is extensive disorganization of the corpuscular elements of the blood. Without going into details, there is good reason to believe that many of the white corpuscles undergo fatty degeneration; and it is certain that the red corpuscles part with their coloring matter freely, the disengaged hæmoglobin giving the saffron hue to the skin and other tissues. It is also worthy of notice in this connection that in malignant cases of yellow fever the blood does not coagulate or coagulates very imperfectly. It cannot be doubted that in milder cases the same destructive agencies are at work for the degradation and disorganization of the blood, and with results similar in kind, but less in degree. From such considerations as these it follows that remedies which contribute to the preservation and improvement of the blood would seem to be indicated in the treatment of yellow fever. And, indeed, such remedies have been extensively used in yellow fever, but for the most part with very moderate success.

(9) Along with this characteristic depravity of the blood, yellow fever exhibits an unexampled range of hæmorrhages. We have hæmorrhages from all the mucous membranes—from the mouth, the nose, the stomach, the bowels, and the uterus—and from blisters and abrasions of the skin. Doubtless these hæmorrhages are due to two causes—first, to the fluid and disorganized condition of the blood itself, and secondly, to the want of vital tonicity in the walls of the capillary blood-vessels, with the capillary stasis thence resulting. For the arrest of these hæmorrhages, and for the correction of this hæmorrhagic diathesis, iron, ergot, and the mineral and vegetable acids and astringents have been employed.

(10) The pathological aberrations of the liver in yellow fever are quite marked. In fatal cases there is always found to a greater or less

extent fatty degeneration of the hepatic cells and capillaries. In addition to the fat due to local degenerative changes, there is usually found a much larger amount of fat due to the infiltration of fat absorbed from the blood circulating through the portal system of blood-vessels. The presence of so much fat in the liver gives to it that characteristic color which has been likened to boxwood, to new leather, and to *café au lait* At the same time, the proper functions of the organ are either entirely suspended or largely diminished; and this is specially true of the secretion of bile and the construction of urea. It is natural to suppose that, in consequence of this disability of the liver to discharge its usual functions with efficiency, the products of the retrograde metamorphosis of the tissues accumulate in the organism, and so bring about a condition similar to that commonly known as uræmia. In the mean time, there are in the liver no evidences of antecedent inflammation to account for the remarkable pathological changes that are present. The administration of mercury and other cholagogue medicines has not been found to influence materially this condition of the liver. In the mean time, one of the most notable things connected with the clinical history of yellow fever is the ease and rapidity with which this organ, so remarkably affected, returns during a short convalescence to its original integrity.

(11) Next to those found in the liver, the most notable pathological lesions of yellow fever are found in the kidneys. Here we have fatty degeneration of the epithelial cells lining the uriniferous tubules, and at the same time more or less fatty degeneration of the renal parenchyma. *Pari passu* with the progress of these degenerative changes there is a continually increasing percentage of albumin in the urine, with a continually diminishing quantity of urine, which in many fatal cases goes on to complete suppression. Scanty urine with a large percentage of albumin is always a symptom of ominous import. Complete suppression of urine is always fatal. When the kidneys become seriously involved the usual diuretic remedies seem to have very slight power to restore their functional activity. And yet during convalescence the kidneys regain their physiological integrity as rapidly as in the albuminuria of pregnant women after parturition.

(12) The gastric mucous membrane is not inflamed in yellow fever, nor is it congested except in patches here and there. Such congestion as there is, is entirely passive, and is perhaps partly due to obstruction of the portal circulation. Briefly, the pathological changes found in the stomach post-mortem do not account for the embarrassment and distress which it exhibits during the progress of a severe case of yellow fever. There is a feeling of weight and humming and general discomfort, with nausea and intolerance of pressure, which we can only vaguely ascribe to some abnormal condition of the gastric ganglia and the gas-

tric nerves. The welfare of the patient is very largely dependent on the physiological integrity of this organ, and hence it needs to be managed with very wise discretion. It must not be overtaxed with either food or medicine, and whatever complaints it utters, whether in the way of craving or of protest, must receive prompt attention.

(13) The bowels in yellow fever are not usually, in any proper sense of the word, constipated. They are simply lethargic, torpid, sluggish, like so many other organs in this disease, and yield promptly to gentle purgative stimulation. It has been strongly suspected of late years that the yellow-fever microbe has its habitat in the bowels of the yellow-fever patient, and that it generates there the ptomaïne which is subsequently absorbed into the blood with such terrible results to the whole organism—just as a similar genesis is ascribed to typhoid fever. In harmony with this hypothesis, purgatives, and especially hydragogue purgatives, to wash out and expel the offending microbes, would seem to be important agents in the treatment of this malady. But experience does not seem to favor their frequent or protracted use in either typhoid fever or yellow fever.

(14) The functions of the brain and the nervous system generally, especially the functions of the great sympathetic, are all profoundly depressed by the influence of the yellow-fever poison. In many fatal cases evidence is found of intense hyperæmia of the pia mater cerebralis and of the substance of the brain itself, with fatty degeneration of the capillaries, infarctions, and small ecchymoses. These conditions also obtain in the medulla oblongata and in the lumbar portion of the spinal cord—not in the cervical and dorsal portions of the cord. In these lesions we have a large part of the explanation of the headaches, neuralgias, insomnias, and deliriums which are so common in many of the severer cases during life. The involvement of the great sympathetic is shown by the marked lethargy of all the organic functions, by the tendency to cardiac debility, by the sighing respiration, and by the gastric irritability, anorexia, and discomfort. It is consequently a fundamental principle in the treatment of yellow fever that the nervous energy of the patient must be sustained in every possible way—by perfect rest of body and mind; by such nerve tonics and stimulants, judiciously administered, as may seem best adapted to the special exigencies of special cases; and, after the subsidence of the primary fever, by such easily-digested foods as the enfeebled stomach is able to manage and the enfeebled organism to assimilate.

(15) The skin in yellow fever is usually relaxed, and I know of no other disease in which perspiration is so easily induced and maintained, especially during the stage of the primary fever. Sweating in yellow fever is never a critical symptom, as it nearly always is in malarial fevers. Profusely excreted, as it often is, and standing in beads or

drops on the hot skin, evaporation goes on freely, but seems to exert very little influence in cooling the surface of the patient or in reducing the systemic febrile temperature, as determined by the thermometer in the mouth or in the axilla; and the moist skin often imparts a peculiarly hot and pungent sensation to the hand laid upon it. The reaction of the sweat to test-paper is acid. In a few exceptional cases the sweat is cold, colliquative, very profuse, and very persistent. I have known it to be so profuse as not only to wet the clothing and bedding of the patient, but to soak through a thick mattress and drop down in little puddles on the floor under the bed. Such cases always die in a few days. This spontaneous tendency of yellow-fever patients to sweat has seemed to many a natural indication that ought not to be disregarded, and has suggested sweating as a means of cure. With this intention use has been made of hot foot-baths, hot drinks, close rooms, and abundant covering with blankets. It is argued in favor of this treatment that the skin in this way is made to a considerable extent to assume the depurating functions of the kidneys, so that the kidneys in the mean time are relieved of a considerable part of the labor that would otherwise be imposed upon them, and are thus less liable to break down from overwork. It is in accordance also with this view that by a few physicians the use of jaborandi and pilocarpine has been advocated in the treatment of this disease. I know of no statistics of cases that support the superior efficacy of the sweating treatment, and it is now very generally abandoned. Neither do I know to what extent the products of the retrograde metamorphosis of the tissues may be excreted by the process of perspiration; but I suspect that the amount of depuration thus obtained is not very great.

The yellow discoloration of the skin is a notable symptom in this disease, and has given it the name by which it is most commonly known in half a dozen languages. This discoloration is a true hæmatogenous jaundice, and is owing to the diffusion of the coloring matter of the blood. It is not confined to the skin, but extends to all the tissues of the body, especially, after the skin, to the mucous membranes and to the accumulations of fat wherever found. But it is to be borne in mind that in the majority of the cases that recover this yellow discoloration does not present itself at all, or only to a very slight degree. It is apt to show itself in severe and protracted cases. Nevertheless, a considerable number of cases reach a fatal termination without any exhibition of the characteristic color; but such cases turn yellow very rapidly after death, so that all yellow-fever cadavers are yellow.

(16) The vomiting in yellow fever requires some mention. If vomiting occurs at the beginning of an attack, either spontaneously or as the result of an emetic, the vomited matters may occasionally contain bile, but this is by no means the rule. Usually the vomit at this

stage contains only the fluids and solids recently taken into the stomach. Later on, in the stage of calm or of secondary fever in protracted and dangerous cases, a different sort of vomiting may occur. Besides the ingested fluids, a clear, thin, mucous fluid may be thrown up, in which float a few darkish-colored shreds of epithelium. This is known as white vomit, and the included shreds have been likened to bees' wings or spiders' webs. This white vomit is the precursor of the dreaded black vomit, but the black vomit may come without any such forerunner. It is thrown up, this terrible black vomit, without any straining or apparent effort, and often with such force that it is projected to the foot of the bed or against a low ceiling. It is composed of disorganized blood-corpuscles, the coloring matter of the blood, the acids of the stomach, and watery fluid. Upon being allowed to stand for a little while in the receiving vessel, it separates into two parts—a dark granular matter, like coffee-grounds, which sinks to the bottom, and a clear acid, supernatant watery fluid. The amount thrown up is often very considerable, and it has been picturesquely said that along with this so-called gastric hæmorrhage flows away the life of the patient. It is certainly an unfavorable and very dangerous symptom. A few adults and a considerable number of children have black vomit and recover; but, as a rule, it is the harbinger of death. In the mean time, it must be seriously doubted if the amount of blood lost in this way is of sufficient quantity to account for the fatal result that follows. The more probable explanation is, that the black vomit is symptomatic of such a condition of the blood, and of such lesions of the kidneys and the liver, as make recovery almost impossible. The mere act of emesis is of no great consequence, and after the materials composing the black vomit have once found their way into the stomach, their speedy ejection is perhaps beneficial. The first effect of the emesis is at any rate a decided feeling of relief. There are fatal cases of yellow fever without the appearance of black vomit; in some epidemics there are a good many such cases. But I have never seen a post-mortem examination without finding more or less black vomit in the stomach. I have seen the vomit when first thrown up of a bright pink color, but it soon turned black.

(17) The leading pathological lesions found after death in yellow-fever cadavers, as has been already indicated, are lesions of the liver, the kidneys, the brain, the sympathetic ganglia, and the stomach; and the lesions of the stomach are much less prominent than the great distress of that organ during the progress of the disease would lead us to expect. It is worthy of remark that all these organic lesions are associated with fatty degeneration. Indeed, acute fatty degeneration is the cardinal fact in the pathology of yellow fever—fatty degeneration of the secretory cells of the liver, fatty degeneration of the epithelium of

the tubules of the kidneys, fatty degeneration of the ganglions of the great sympathetic nerve, fatty degeneration of the epithelium of the capillary blood-vessels, and fatty degeneration, in a lesser degree, of the muscular fibres of the heart and other organs. In the mean time, the lungs, the spleen, and the bowels show comparatively little evidence of pathological aberration.

(18) The chemical phenomena of yellow fever have not been adequately investigated. We know that notwithstanding the diminished excretion of urea and uric acid there is no accumulation of these compounds in the blood. We know that there is no accumulation in the blood of bile or of cholesterin. We know that there exists a strong tendency in the disease toward the establishment of an acid diathesis; but of the acid or acids concerned we know very little. No researches have been made with a view to the discovery of the yellow-fever ptomaïnes. Indeed, how such a research would be projected is not very evident.

CEREBRO-SPINAL FEVER (CEREBRO-SPINAL MENINGITIS).

By J. C. WILSON, M. D.

The present article includes the treatment of so-called idiopathic cerebro-spinal fever both in its epidemic and its sporadic form. The treatment of tubercular meningitis, lepto-meningitis as a sequel of the infectious diseases, the meningitis of alcoholism, syphilis, sun-stroke, that resulting from the extension of middle-ear disease, and that from traumatism, does not properly fall within its scope.

The etiology of cerebro-spinal fever remains involved in obscurity. The recent discovery of a bacterium in the purulent exudation of the meninges (Fränkel, Foâ, Weichselbaum, Prudden), the morphological, biological, and pathogenic characters of which establish its identity with the Diplococcus pneumoniæ of Fränkel and Weichselbaum, is, as regards our knowledge of the pathology of the disease, a step in advance, but it in no way aids us in the matter of therapeutics. The treatment of this disease therefore still remains empirical and symptomatic.

Prophylaxis.

This, as all epidemic diseases, usually assumes its worst form and claims the greatest number of victims where antihygienic conditions most abound. At times of epidemic, prophylactic measures include the purification and disinfection of houses and localities and attention to personal hygiene. The thorough cleansing of streets and dwelling-places, close attention to the condition of the drainage and the proper disposition of the sewage, prompt removal of accumulations of refuse matter, and the avoidance of overcrowding are measures which should be at once instituted in the hope of diminishing the severity and mortality of the disease.

The evidence that the fever-poison in some instances spreads among the different members of a household, either from the individual first attacked or by way of his personal effects, or in consequence of some unknown favoring condition of the surroundings, renders it advisable that, where practicable, the dwellings in which the disease has made its appearance should be abandoned until after the close of the epidemic

(Ziemssen). It is recommended that all linen and other articles used by the patients should be carefully disinfected or burned.

The use of plain and wholesome food, the avoidance of unusual fatigue, both bodily and mental, and of excesses of every kind, are important. Moderate exercise, quiet, and regular living may afford some, but by no means complete, security during the epidemic.

Nervous persons and those in feeble health should, when possible, leave an infected district upon the outbreak of the disease.

Treatment.

No one who has carefully studied the records of this remarkable disease, or has had the opportunity of observing it upon an extensive scale, can fail to be impressed by the diversity of its manifestations. It has been well called a chameleon-like disease (Stillé). It cannot be a matter of surprise, then, that the treatment of the disease has been almost as various as its forms. In different epidemics and at different periods divergent and even opposite methods of treatment have been adopted. A vigorous supporting plan has been pursued by those to whom the disease has presented from the onset in an extreme degree the symptoms of depression; again, the urgent symptoms of an intense inflammatory process localized in the membranes of the brain and spinal cord, and passing over to the subjacent nervous matter, have seemed to indicate the energetic use of depletory and other antiphlogistic remedies; while the unsatisfactory results of both these plans, and our want of precise knowledge in regard to the etiology of the disease, have in other quarters led to the adoption of a modified expectant plan of treatment in which a careful regimen and efforts to combat the symptoms as they arise play the chief part.

Attempts to deduce from statistics conclusions in regard to the comparative value of different modes of treatment in an epidemic disease in which the mortality ranges between 30 and 75 per cent. must yield unsatisfactory if not fallacious results. It is not only impossible to compare the results of treatment in different epidemics, but, from the capricious nature of this affection and its various manifestations, it is even impossible to compare cases in the same epidemic, or, indeed, to compare the cases which occur during the rise, the maximum, or the decline of the same epidemic. We have to do with cases of this fever to which the term "average cases" may be aptly applied, as qualifying the intensity of the morbid phenomena and the rate of mortality which attends them, which yet differ among themselves by as many shades as there can be various combinations of the infectious or blood-element and the local inflammatory element which jointly underlie its manifestations. Cases are far from rare in which the attack is of the mildest form, only to be recognized by the lurid light of the outbreak in which

they occur—cases requiring no treatment, sometimes not even compelling the subject to take to his bed. In strong and terrible contrast to such cases are those in which, in the midst of health while at his ordinary occupation or on awaking from sleep, the patient is overwhelmed by the infection as by an avalanche, and, passing rapidly from agonizing suffering to coma, perishes in the course of a few hours. Here the brevity of the course and the nature of the lesions alike show the powerlessness of our efforts to control the attack. Medicine, with all its resources, is neither adequate to combat it nor responsible for its result. As Stillé has said, "The first symptoms of the disease are the first phenomena of death."

We are driven, then, in estimating the results of the treatment, to restrict our observations to the effect of remedies upon the individual patients, the immediate influence upon their symptoms, both subjective and objective, and the permanence of that influence.

A judicious treatment must be based upon the broad general principles of therapeutics.

The room should be darkened and all noises and other disturbing influences avoided. In view of the infectious character of the disease, its rapidly disintegrating effect upon the blood, the early and often alarming debility in some cases, the marked depression that in others follows the active symptoms, the great emaciation and the tedious convalescence, measures of depletion must be employed with the greatest caution, and are in most cases wholly contraindicated. In the young, and particularly in children, the abstraction of even small quantities of blood is liable to be followed by alarming symptoms of depression. Dr. J. Lewis Smith reports a case in which the application of a leech to each temple in a child aged four years was followed by extreme and almost fatal exhaustion. General bloodletting is in no case admissible. It is to be borne in mind that the pulse is almost always, even from the onset, such as would contraindicate the abstraction of blood, and if the urgency of the symptoms of the local inflammation and the critical state of the patient seem to call for the employment of energetic measures, the clinical history of the disease reminds the physician that a no less marked depression is speedily to follow and calls for a thoughtful regard for the future. Even in the sthenic cases cut cups to the nape of the neck and along the spine are to be employed with caution. Leeches may be applied to the temples and in the neighborhood of the mastoid processes. These measures are of great value in mitigating the headache and spinal pains which in many cases are symptoms of such terrible significance.

If such local abstractions of blood be contraindicated by the state of the patient, dry cupping may be employed with advantage.

The direct application of cold to the head and spine by means of ice,

snow, or a freezing mixture in rubber bags is not open to the same objections as bloodletting, and at the same time is often attended with satisfactory results as regards the symptoms of inflammation. If the bags cannot be procured, a bladder filled with cracked ice mixed with bran may be substituted. In children gentle cold affusions may be practised. The application of cold by these means is in most cases followed by very marked mitigation of the pains, and often by quietude or sleep. It should be continued as long as the patient derives comfort from it, and repeated upon the return of the symptoms. Patients frequently require the continuous application for hours at a time. A hot mustard foot-bath, or a general hot bath, 38°–39° C. (100.4°–102.2° F.), should be employed as early as possible, care being taken that the strength of the patient be in no wise taxed. This may be followed by gentle frictions with some stimulating liniment or with oil of turpentine if the surface be cold and the circulation depressed. A stimulating enema may at the same time be administered. The patient should also be covered with warmed blankets and artificial heat applied to his sides, thighs, and extremities. In all cases it is well, while using the cold to the head and spine, to counteract its depressing effect by the application of moderate heat elsewhere. This may be accomplished by means of hot flannels, bags of hot sand or salt, bottles filled with hot water, or heated billets of wood well wrapped up. At the same time, if necessary, sinapisms are to be applied to the extremities and the præcordium.

Bartholow holds that the application of ice to the head and spine may do mischief by the depression of the circulation which it causes. He advises, instead, the use of hot water applied by a sponge passed over the spine every two or three hours. The best modern American authorities agree in advising the continuous use of external heat, to anticipate and counteract the early depression which is so grave an element of the disease—a practice very general in the early epidemics in this country, but for a long time strangely overlooked here and altogether neglected abroad.

Blisters upon the occiput and upon the nape of the neck are not only to be advised upon theoretical grounds, but they are of great practical value in relieving pain and in diminishing delirium, spasm, and coma. They should be applied early in the course of the disease.

The use of mercury, except at the onset of the attack, in the form of a dose of calomel as a purgative, is to be discountenanced. No single drug has been employed to a greater extent than mercury in the treatment of cerebro-spinal fever, but almost all authorities at this time regard with disfavor the employment of the preparations of this metal for its supposed antiphlogistic or antiplastic effect or its absorbent effect upon the exudation. Among German writers, Ziemssen, however, rec-

ommends its use in the form of mercurial ointment or calomel "for the purpose of preventing the extension of the meningeal inflammation and exudation." He employs free inunctions and the internal use of calomel "in almost every case," but admits that when used in connection with other remedies it is difficult to ascertain its share in the common effect, and that even when used alone its efficacy is by no means clearly established.

The antipyretic treatment by cold baths and enormous doses of quinine, as practised by the Germans in diseases attended by pyrexia, can rarely be necessary, for the reason that in most cases the fever is moderate, and in those cases characterized by an excessively high temperature the fatal event is due to other causes than the fever. Quinine has no control over the intermittent variety of the disease. The use of quinine in large doses at the very beginning of the disease is favorably spoken of; but its administration in the later period, when the phenomena all point to intracranial exudation, is of no use, and liable to prove even hurtful except in small doses as a tonic to an enfeebled system.

The statement that this drug has appeared to abort the disease in some instances is not borne out by sufficient evidence. There is no abortive treatment.

Opium, by the concurrent testimony of all observers, holds the highest place in the treatment of this disease. It was used in America in the early part of the present century, adopted as a treatment in France at a later period, and has recently found favor in the eyes of the physicians of Germany. Ziemssen says of morphine that it "may be regarded as one of the most indispensable remedies in the treatment of epidemic meningitis."

All the distressing symptoms—the headache and spinal pains, restlessness, the spasm, the hyperæsthesia, and the inability to sleep—call for the administration of this drug. Our knowledge of the nature of the lesions also suggests its use. Opium slows the heart and increases arterial tension. It is to be employed at the earliest moment possible and in full doses. By this means we may anticipate the occurrence of exudation or limit it. Experience has shown that a remarkable tolerance for this drug exists in most cases of cerebro-spinal fever. Some of the older physicians gave large doses. Strong in one case "gave sixty drops of laudanum every hour till half a fluidounce was taken. The whole of it was retained, and it subdued the excitement and relieved the pain, but produced no sleepiness or other apparent effect of opium." Others among the early American writers gave enormous doses—½ ounce of the tincture or from 30 to 60 grains in substance in the course of twelve hours being necessary to control the urgent symptoms. Such cases recovered. Chauffard, to whom Hirsch erroneously

ascribes the first advocacy of the opium treatment, gave it in doses of from 3 to 15 grains. Boudin frequently gave 7 to 15 grains at a single dose at the commencement of the attack, and afterward 1 to 2 grains every half hour. As soon as the symptoms abated or the patient became drowsy the dose was diminished. Stillé gave 1 grain every hour in very severe cases, and every two hours in moderately severe cases, without narcotism or even an approach to that condition. He adds that "under the influence of the medicine the pain and spasm subsided, the skin grew warmer and the pulse fuller, and the entire condition of the patient more hopeful."

We are struck with the correspondence between these statements and those of the late Alonzo Clark and his followers in regard to the treatment of puerperal peritonitis by massive doses of opium. The remedy must be given for its effect, and the quantity necessary is to be prescribed. Its greatest usefulness is to be reached only by its administration early in the course of the disease. After the symptoms indicative of effusion appear, it must be given in smaller doses and its utility is greatly diminished. It is among the most notable facts respecting the use of opium in this disease that the early American physicians did not hesitate to employ it when coma threatened—a condition usually thought to preclude the use of narcotics—and Strong and others have recorded their opinion that it is a powerful agent in removing such comas as are not "absolutely irrecoverable."

When the condition of the patient is such as to render its administration by the mouth impracticable, or when the repeated vomiting prevents its absorption, the opium may be given in the form of enemata or suppositories, or one of the morphine salts may be substituted in hypodermic injections. The latter is in most cases the best plan of treatment.

In view of the fact that children are peculiarly susceptible to the action of this drug, the dose must be regulated with caution. A boy aged six years, under the care of Dr. J. Lewis Smith, was quieted by the subcutaneous injection of $\frac{1}{32}$ of a grain of morphine sulphate.

Ergot and belladonna have been used upon theoretical grounds, on account of their influence in diminishing vascularity of the nervous centres, but the evidence of their value is not satisfactory. Rosenthal urges great caution in the administration of belladonna and in the hypodermic use of atropine.

Cannabis indica, the fluid extract of gelsemium (Bartholow), zinc oxide, large doses of chloral hydrate, and inhalations of chloroform have been employed in the management of the stage of excitement. Chloral is to be emphatically condemned in the treatment of a disease attended with vomiting so continued as often to interfere with the assimilation of food, and characterized by a tendency to extreme exhaustion; so also chloroform inhalations, when from the outset

we often have to do with a feeble and irregular action of the heart, showing itself in extreme weakness and irregularity of the pulse, and a tendency to syncope upon assuming the upright posture; of the others it may be said that they are useful auxiliaries to treatment, but that they do not in severe cases constitute an efficient medication.

The last remark holds true also of potassium bromide, a remedy which has, however, great value in the treatment of mild cases and in the treatment of children. It may be advantageously combined with opium or morphine.

In cases of extreme urgency the inhalation of Squibb's ether may be resorted to for the purpose of securing temporary relief from the torturing pain, the jactitation, and the spasm.

Veratrum viride and aconite have been used in the treatment of this disease in its early stages. The use of these drugs in sufficient doses to produce their physiological effects is based upon unwarrantable assumptions in regard to the nature of the disease, and is not justified by the results of experience. On the one hand, the inflammatory processes and the hyperæmia accompanying them are due to the direct local action of the infecting principle, not to any over-action of the forces of the circulation or increase of vascular tension. On the other hand, the speedy development of a high grade of cardiac asthenia with small, feeble, and irregular pulse, points conclusively to the depressing action of the infecting principle upon the circulation, and emphasizes the impropriety of the employment of depressant remedies at any period of the disease.

Of the employment of the new analgesics in the treatment of this affection the writer has had no experience. From what we know of their action there is little to be looked for in their exhibition in ordinary doses in the severe cases, and the use of large doses is attended with the danger of depression. In mild cases, however, and particularly in the lightest forms of the epidemic disease, the use of antipyrine, phenacetin, and exalgin will doubtless prove of service in mitigating the headache and holding in abeyance the neuralgic pains.

Upon the approach of depression excitants and stimulants are to be resorted to. Among the more useful are ammonium carbonate, spirit of chloroform, turpentine, and the preparations of alcohol. Cold affusion, practised several times a day, is recommended by German writers. It is a remedy scarcely likely to be widely used in this country. Quinine may be given in moderate doses.

Alcoholic stimulants are required at some time in the course of the majority of cases. Their use as a remedy in the treatment of this fever, independently of the indications which govern their use in the general management of diseases, has not been followed by satisfactory results. They are to be promptly employed when symptoms of depres-

sion of the nervous system show themselves, whether it be at the onset of the attack or later in the progress of the case. Their amount must be regulated by the effect which they produce. The pulse and the first sound of the heart are the best guides. If the pulse after the administration of alcohol becomes less frequent, stronger, and fuller, and the first sound more distinct, it is beneficial; but if the pulse increases in frequency, the heart's action being excited, the tongue grows dry, and the excitement augments, the alcohol must be given in smaller doses or abandoned. If the need be urgent and the patient unable to swallow, brandy should be given hypodermically.

During convalescence the vegetable tonics and iron are to be employed. Arsenic, and especially potassium arsenite, are also useful at this period. The latter has been praised as a remedy of value in the management of the acute disease. These praises are unfounded. Cod-liver oil is of use, and in proper cases potassium iodide is of proved service in promoting the absorption of the exudation. Its use should be long continued, and at the same time flying blisters in the occipital region, daily hot affusions, and, after all acute symptoms wholly cease, mild continuous galvanic currents, should be employed.

Potassium iodide is not of use in the treatment of cerebro-spinal fever during its acute course. Ziemssen states that he has not found it of the slightest benefit in the chronic hydrocephalus occurring as a sequel—a result which the nature of the lesions in that affection would lead us to expect.

A generous alimentation is to be given from the beginning of the sickness. During the continuance of the febrile phenomena milk, eggs, meat-juice, and broths should be given at regular intervals, and continued in severe cases during the night. If food cannot be taken by the mouth, an attempt should be made to administer nutritious enemata.

As soon as he is able the patient should be allowed an abundance of solid food. The appetite is often excellent, even in the early days of convalescence.

When there is thirst the desire for water must be freely gratified. This symptom is often very distressing.

Constipation may be relieved by a dose of calomel with or without jalap, by other simple drugs, or by enemata. Neither constipation nor diarrhœa is, as a rule, difficult to relieve.

When there is much prostration, and, indeed, in most cases, the patient should be guarded against assuming the erect posture, or, in truth, against even sitting upright in bed, on account of the danger of syncope.

Delirium, spasm, and irritability of the stomach too often in the severe cases render the administration of medicine and food impracticable.

DISEASES OF THE NASAL CHAMBERS.

By RALPH W. SEISS, M. D.

The prevention of recurrent attacks of acute coryza is one of the most important problems of treatment in nasal diseases, and calls for careful consideration. The means to be employed will vary with the underlying causative factors, which in the great majority of instances are either vaso-motor disturbances, the gouty diathesis, or generally defective nutrition. Each of these conditions, when present, calls for the treatment, hygienic or otherwise, which may seem best suited to the particular case.

More general measures may be discussed under the headings of Exercise, Bathing, Clothing, and Local Prophylaxis. Vigorous but properly-directed "training" is an exceedingly valuable means of controlling the "catarrhal tendency," and in fairly healthy young subjects should always be advised. Horseback riding is probably the best exercise in most cases; walking and running rank next; "wheeling" uses too limited a set of muscles, but is admirable, if combined with indoor exercises, for the arms, back, and chest. Light gymnastics may be ordered for patients not sufficiently vigorous to take the heavier forms of exercise. It has frequently been a surprise to the present writer to note the rapid improvement in catarrhal cases where "training" suited to the strength of the individual has been ordered, even after local treatment had failed to give satisfactory results.

Regular and frequent bathing, combined with daily cold sponging of the face, neck, and chest, is decidedly beneficial in preventing "colds," but in cases in which the vaso-motor system is much below par considerable caution is necessary. Cold plunge-baths are frequently the reverse of useful in weak and catarrhal subjects, and should be prohibited, at least during the winter months. Energetic friction, either with a plain rough or "salted" towel, must always follow the bath, and should be continued until the skin is decidedly reddened. More elaborate methods of using water as a vaso-motor tonic will be found described in Volume I. of this work.

Patients with strongly-marked catarrhal tendencies should wear woollen under-clothing of sufficient weight at *all* seasons, garments of at least *three* degrees of thickness being required: the heavier

weights should be put on with every marked fall of temperature, whatever the season. Under-clothing which has become damp from perspiration should be changed as soon as possible, even though this may necessitate dressing several times during the day. The wearing of warm woollens at night is a point much neglected, but of great importance; in no case, however, should the clothing worn during the day be retained. Woollen stockings should be worn during the winter months, and stout-soled shoes in all weathers, with the addition of rubber overshoes on wet days. Waterproof leather shoes are something the writer has never been able to find, and damp feet are always a serious menace to persons of catarrhal tendency.

In considering the local prophylaxis of nasal inflammation the etiological factors which act directly on the Schneiderian membrane should be remembered. Bad air of all sorts acts as a direct irritant to the mucous membrane of the nasal cavities; air laden with particles of wool or minute fragments of some hard substance, such as coal, stone, or steel, is the worst of all; but all inhaled solid matters are injurious. Gases are less directly hurtful, and act more through the lungs and general circulation than directly on the nose; but many, especially derivatives of sulphur, are capable of producing severe nasal inflammation.

Patients whose occupations compel them to breathe an irritating atmosphere should wear a respirator or a flat, dampened sponge over the mouth and nostrils while exposed to it. The occasional use of some mild alkaline spray also serves to control the injurious effects of dust-laden air; probably there is no better fluid for the purpose than Dobell's solution, the formula of which is appended:

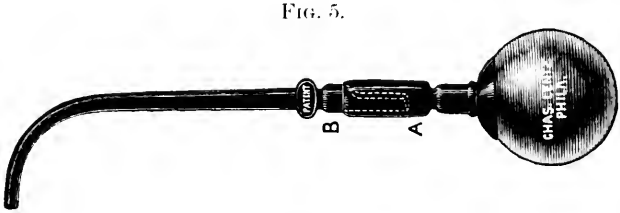
℞. Sodii boratis (C. P.),
Sodii bicarbonatis, " āā. gr. viij;
Acidi carbolici, " gr. iv;
Glycerini, ʒij;
Aquæ destillatæ, q. s. ad ʒiv.—M.
Sig. Use in atomizer.

Modern nasal therapeutics includes the use of remedies in solution as sprays or pigments, or their application in the form of powders by means of various insufflators; also the use of chromic acid and other caustics, electricity in the form of both constant and interrupted currents, and the galvano-cautery. Special surgical procedures are also required in a large number of cases, for the performance of which various forms of snares, curettes, forceps, and knives have been devised. All methods of local treatment require for their proper application the head reflector and the nasal dilator, as well as a bril-

liant and controllable light: an argand gas-burner and the "Rochester" lamp are both to be recommended for this purpose. The greater number of remedies used in the nasal chambers are best applied as sprays by means of an atomizer: a vast number of these instruments are now in the market, but by no means all are satisfactory when in use; the writer commonly employs the "Perfect," "Burgess," or "Llewellyn" models for all aqueous fluids. For solutions in oil a number of special forms have been devised by different manufacturers, the choice of which is largely a matter of individual taste: the "Magic," No. 1, is probably unexcelled for this purpose, at least for office use. Pigments are best applied on cotton brushes, made by wrapping the roughened end of suitable applicators with absorbent cotton, any desirable shape or size being given to the mop. Instruments for this purpose can scarcely be too delicate, the generality of nasal probes being unnecessarily large and heavy.

Insufflations of drugs in powder are not used by the writer, solutions in oil having superseded them in his practice: their use is, however, highly lauded by many rhinologists. The instrument figured above is the form usually employed: the remedies must be in the finest possible powder; if *bolted* their irritant effect will be much lessened. The formulas which have been found most useful in nasal disease, and the special surgical procedures indicated, will be described in detail under the various types of inflammation.

FIG. 5.



Powder-blower.

ACUTE CORYZA.

THE abortive treatment of an ordinary "cold in the head" is successful in many cases. The technique, which must be carried out in the early stages of the disease, consists in first thoroughly cocainizing the nasal mucous membrane, from 3 to 5 drops of a 5 per cent. solution being injected into each nostril by means of an ordinary medicine-dropper. After complete contraction has taken place, which usually results within five minutes, the nasal chambers are to be gently

but thoroughly sprayed with some mildly antiseptic solution, of which the following is perhaps the best:

℞. Listerine (Lambert), f℥iv;
Acidi borici, gr. xx;
Aquæ rosæ, f℥iv.—M.
Sig. Use in atomizer.

Complete nasal respiration being established and all mucus washed from the nasal cavities, the membrane may be coated with a carefully *bolted* powder composed of sulphate of morphine, with atropine in minute quantities, in combination with subcarbonate of bismuth and powdered acacia. The remedy is to be applied by means of the laryngeal powder-blower, under full inspection by means of the forehead mirror and nasal speculum. Much better than the foregoing are sprays of liquid *albolene*, containing eucalyptol, menthol, camphor, etc., the surface of the membrane being thoroughly coated with the oil after cleansing by means of the watery solution. The appended recipe is much used by the writer:

℞. Menthol., gr. iij;
Camphor., gr. v;
Albolene (liquid), f℥j.—M.
Sig. Use in atomizer.

Internally, a small dose, $\frac{1}{12}$ to $\frac{1}{8}$ grain, of morphine, given at bedtime, together with a hot whiskey-lemonade, will complete the cure in the case of many patients. Full doses of quinine act well as abortives in occasional instances, but in others seem rather to increase the nasal congestion, and are at all times a serious menace to the ears, which may be already in a state of irritation from congestion of the lining of the Eustachian tubes.

In cases in which the patient has not applied for treatment until the acute coryza has fully developed the foregoing method may be followed, but cocaine should be omitted; as, after infiltration has progressed, it serves only to lower the tone of the membrane and often to prolong the disease. Rather large doses—15 grains three or four times a day—of sodium bromide may now be given; and they seem greatly to shorten the duration of the attack, and certainly add to the comfort of the patient. In severe cases, in which the larynx and bronchial tubes have participated in the inflammatory condition, tonic and stimulating remedies are usually indicated late in the course of the affection; strychnine and a reliable wine of coca are favorites with the writer.

In children much of the above treatment must be necessarily

omitted, but the solutions can be used in nearly every instance if a well-shaped medicine-dropper be substituted for the atomizer. The *vapor* of menthol acts very well if properly used: the crystals should be added, *one by one*, to a cup of boiling water held near the child's nose, and the little patient encouraged to breathe the fumes. If the menthol be added too rapidly, the vapor becomes very irritating and disagreeable, much distress and harm resulting. The child must of course be most carefully protected from draughts or temperature-changes, and all possible complications watched for. An ointment composed of 1 part pure lanolin to 2 of solid albolene, liberally applied over the nose externally, seems to have a comforting and beneficial effect. Bromides act even more favorably in children than in adults, and should be given in corresponding dose; the syrup of lettuce makes an admirable vehicle, and has itself a distinctly quieting effect.

IDIOSYNCRATIC CORYZA.

Synonyms.—Hay fever, Rose cold, Autumnal catarrh.

As this condition is certainly increasing in frequency in this country, its successful treatment has become a matter of very great importance. In about one-half the cases the disease can be so perfectly controlled that it might be considered cured; the majority of the incurable cases can be greatly relieved, but a certain proportion of patients seem only to be made worse by every therapeutic means tried. The latter class is, fortunately, a small one, and for these nothing remains but a residence in some locality which is exempt from the affection, such as the White Mountains, Fire Island, L. I., and numerous resorts in the North and West, during the period of attack.

The therapeutic management of hay fever is divisible into that proper for the attack and the methods which may be used during the interval to prevent recurrence of the disease.

The knowledge that a sufficiently strong solution of a salt of cocaine will perfectly relieve an attack of idiosyncratic coryza *for a short time* has been a baneful lesson to many sufferers. The alkaloid has not the slightest curative power, but decidedly the reverse, and its constant use in *strong solution* is invariably followed by constitutional poisoning and serious results. Properly used, however, as an adjuvant to more radical measures and to tide a patient over sudden paroxysms of irritation, it is a most valuable agent in this disease. The solution used should never exceed 10 per cent. in strength, and 5 per cent. is sufficient for the majority of cases, and the applications must not be made oftener

than two or three times in the twenty-four hours. To apply the solution the patient should bend the head backward and inject a few drops of the solution into the nasal chamber; frequently only one side will require anæsthetizing to secure relief. Next in value in the paroxysmal stage of hay cold is menthol, which may be used as an inhalent or dissolved in albolene oil. A satisfactory inhaler may be made in a few minutes by smoothing off one end of a glass tube, which should be about four inches long and of a diameter to fill the nostril. A light tuft of cotton is placed in the middle of the tube, some crystals of menthol dropped upon it, and a second tuft of cotton placed over the medicament: one extremity of the tube being fitted in the nostril, the heat of the hand serves to vaporize the menthol, which is to be breathed into the nasal chamber. If used as a solution, the strength should not exceed 6 grains to the ounce; 3 grains, combined with camphor, as advised in acute coryza, will usually be found more grateful to the patient. Cubeb cigarettes give great comfort to a few cases, the smoke being allowed to escape from the mouth through the nostrils; from three to five may be smoked per *diem*. During the height of the attack aqueous sprays seem very often to act as irritants, and if used at all must be chosen with great care and applied with the utmost gentleness. Spray inhalations by the *mouth*, on the other hand, often act admirably in allaying irritation of the lower respiratory tract. Minor points, such as the wearing of blue glasses when the eyes are much irritated, or of some form of respirator if much dust is to be encountered, are always worthy of attention, and the mode of life must be as hygienic as possible. In no case should any active treatment be attempted during the paroxysmal stage, and all irritative therapeutics, especially the use of any powders in the nasal chambers, are, in the writer's opinion, most decidedly contraindicated.

Of internal remedies valuable in the acute stage of idiosyncratic coryza, morphine is the most reliable, and but for its depressing constitutional effects it would be a most useful agent in this affection. From $\frac{1}{16}$ to $\frac{1}{12}$ grain of morphine sulphate may be given twice or oftener *per diem*, and it will assure comfort in most instances.[1] But the effect of the alkaloid on the general health is so disastrous that it can be tolerated only when given at considerable intervals. Atropine may be given alone or combined with morphine, but is much less useful and far more dangerous than the latter alkaloid: quinine and sodium bromide are useful when the general circulation is much disturbed, and excellent results from the use of antipyrine have been reported.[2]

In the interval between the annual attacks a hay-fever patient

[1] See S. N. Bishop, *Journ. Amer. Med. Association*, 1887.

[2] For use of antipyrine, etc., see A. Bloch, *Med. Register*, 1887.

should undergo a most careful naso-laryngeal examination, and all local causes of irritation should be removed. If hypertrophy or any form of chronic rhinitis be present, it must be cured, any serious obstructions to respiration, whether ecchondroses, bony enlargements, or polypi, must be removed, and all hyperæsthetic areas should be cautiously cauterized. The localization and destruction of these sensitive centres comprise the successful treatment of the disease: they should be thoroughly looked for by careful probing under full illumination, and when found are to be lightly incised with the galvano-cautery needle. If every area of abnormal sensibility can be found, and the nerve-endings destroyed, there will usually be no return of the paroxysms. The matter may be easily overdone, however, and a patient with nasal sclerosis, the result of reckless galvano-cauterization, is in a far worse condition than are most sufferers from hay fever. Chromic acid may be substituted for the electric knife, but is less efficacious and much less controllable. Prolonged treatment with tonic and mildly-astringent sprays is always indicated; the distilled extract of hamamelis, diluted with an equal amount of rose-water, is one of the most useful solutions for the purpose. Constitutionally, tonics are very often required, and a large supply of fresh air and regular exercise, combined with long hours of perfect rest, are needed in nearly every case of hay fever, "neurasthenia" and vaso-motor-disturbances being the rule in this disease.

It should be remembered that cases of "false hay cold," or vaso-motor coryza, are far from rare, the victims undergoing the characteristic torments of the disease at any and every season, and from even such remote exciting causes as mental impressions. These patients are always neurotics, and need the treatment proper for such cases: local therapeutic measures should be the same as for the typical form of the disease. Asthma, neuralgia, and other reflex neuroses are also occasionally dependent on nasal disease: their proper treatment consists in localizing and curing the local lesion.

SIMPLE CHRONIC RHINITIS.

Persistent inflammation of the nasal mucous membrane, unaccompanied by hypertrophic changes, is not very frequently seen by the rhinologist, but, as such cases do report for treatment, and as this is undoubtedly the first stage of the hypertrophic process, its successful management is of considerable importance. In this condition properly chosen and skilfully applied sprays have almost a specific effect, and

will arrest the disease and secure perfect comfort for the patient in the great majority of instances.

The appended formulas are among the most useful:

℞. Listerine (Lambert), ʒiv;
Sodii bicarbonatis,
Sodii boratis, āā. gr. viij;
Aquæ rosæ, q. s. ad f℥iv.—M.
Sig. Use in atomizer.

℞. Zinci sulphocarbol., gr. x;
Acidi carbolici, gr. iv;
Aquæ destillatæ, f℥iv.—M.

Solutions of hamamelis, as suggested in hay fever, and of the iodide of zinc, also act very well in certain cases; resorcin is highly recommended by Sajous in the strength of 5 grains to 1 ounce of water. The pharynx and larynx require attention quite as much as the intranasal region, as a rule, and all sources of irritation, constitutional or local, are, if possible, to be removed. It should be remembered that stubborn attacks of rhinitis are one of the phenomena of gout, and in such cases require the constitutional treatment proper for that disease. The conjunctivæ are usually implicated in this condition, and recurring attacks of inflammation both of the eyes and the nasal mucous membrane are characteristic of gouty rhinitis. All forms of irritating dust and foreign materials generally in the air produce rhinitis, and must be excluded if improvement is to be secured. Minute fragments of wool and of carbon, and the alkali dust of certain areas in the West, are especially apt to produce intractable catarrh.

Uncomplicated cases of rhinitis simplex usually run a perfectly favorable course under treatment, and can generally be dismissed after three or four weeks. Left to run its course, hypertrophies soon form, and secondary lesions in the pharynx, larynx, and Eustachian tubes more or less speedily occur. It is therefore of the first importance to begin therapeutic measures in the earliest stages of nasal inflammation, before organic changes have occurred; and undoubtedly the great majority of cases of aural catarrh, chronic laryngitis, and similar sequelæ could thus be prevented.

CHRONIC HYPERTROPHIC RHINITIS.

This, in our Atlantic climate, is the commonest form of nasal disease, and is found in some one of its stages in perhaps one-third of our adult population. It is the most prominent cause of deafness, throat and bronchial disease, and of numerous obscure conditions of the eyes

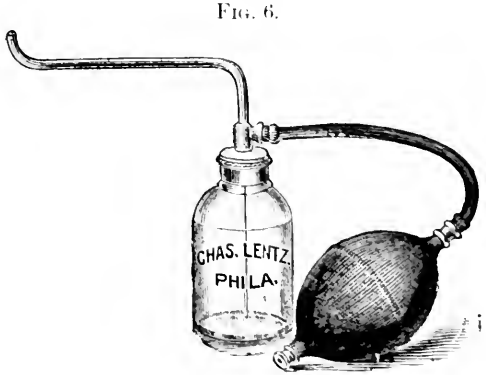
and cerebral circulation. Its therapeutic management is therefore deserving of the closest study. In its early stages the treatment of hypertrophic catarrh does not differ essentially from that advocated for simple rhinitis: the same sprays can be used, but the applications may need to be continued for some months and the solutions slightly increased in strength. Light pencillings with iodine also act well in this type of the disease: the following formula is of a standard strength which may be diluted if necessary:

℞. Iodini (cryst.), gr. x;
Potassii iodidi, gr. xl;
Glycerini, f℥j.—M.
Sig. Use on cotton brush.

The technique of such applications is of the first importance. If the solution be simply brushed carelessly over the entire mucous membrane, much unnecessary irritation is caused, and the remedy may be harmful rather than beneficial in its results. The cotton carrier should be a light steel one, such as is used by aurists, and the cotton mop must not exceed three or four millimetres in diameter. The pledget, being saturated with the medicament, is to be lightly passed backward along the lower turbinated body until the posterior pharyngeal wall is reached, care being taken not to rub the iodine over the floor of the nasal chamber or the septum.

When the nasal secretion is thick and glairy, and can be removed by the patient only by means of violent hawking and blowing, the curved post-nasal atomizer is essential to a thorough cleansing of the

Fig. 6.



Post-nasal Atomizer.

nasal chambers. Dobell's solution or one of the formulas previously given may be used. The nozzle of the instrument being introduced through the mouth and well up behind the palate, the post-nasal space

is to be thoroughly washed out, the atomizer being removed and reintroduced from two to four times until the nose is perfectly cleared. In cases in which the pharyngeal tonsil is irritated and inflamed, as

Fig. 7.

Post-nasal Applicator.

shown by the rhinoscopic mirror, post-nasal applications of glycerite of tannic acid, 40 grains to the ounce, or of iodine in glycerin, made by means of the curved applicator through the mouth, are of much value.

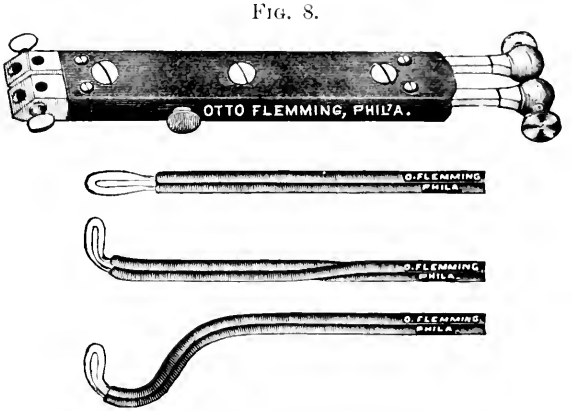
The head-mirror and tongue-depressor are always necessary in carrying out any treatment in the region of the posterior nares, and the utmost care and gentleness is essential, the parts being most intolerant of injury. Medical therapeutics directed to the pharynx and region of the tonsils are of very great importance in nearly all cases of nasal catarrh.

The surgical management of hypertrophic rhinitis is too extensive a subject to be considered in detail here, and the more general principles only can be considered. Soft and vascular enlargements, which do not contract sufficiently under medical treatment, may be perfectly cured by one or more "tackings" with chromic acid, used according to the following technique: The area to be cauterized is first fully contracted and anæsthetized by the use of a 5 per cent. solution of cocaine hydrochlorate, which is best applied by saturating a small pledget of cotton and tucking it up between the septum and the surface of the turbinal. From five to ten minutes are required to secure the full effects of the drug in contracting and benumbing the tissues. The chromic acid is to be used on a very delicate but firm cotton-carrier in the form of a fused bead, or a few crystals can be made to adhere to a small and tightly-wound cotton tuft by slightly dampening it with water. The latter method is the simplest and safest, as the fused acid deliquesces very rapidly, and is apt to spread unpleasantly when used in the nose. The charged portion should not exceed two millimetres in diameter if the moist acid be used, and the dry bead must not be larger than the head of an ordinary pin. The moistened applicator having been prepared, the cocaine pledget is removed and the acid carried under full inspection to the point of greatest hypertrophy, and held firmly in contact with the mucous membrane for at least twenty seconds. Great condensation of the turbinated tissue at the point of contact results, together with a slough of varying but always shallow depth, the

ultimate and speedy effect being to bind down firmly and permanently the redundant tissue. Immediately after using the acid the nares should be sprayed with some alkaline solution to prevent its spreading: Dobell's solution answers the purpose admirably. The cauterizations may be repeated at intervals of ten or twelve days until phy-siological respiration is secured, sedative sprays being employed during the interval.

Where fibro-blastic changes have taken place in turbinated hypertrophies, rendering them less vascular and denser in structure, more energetic means are required to reduce them. It should not be forgotten that contraction has already commenced in these enlargements, and that if operative measures be in the least overdone sclerosis and atrophy, most pernicious to the patient, will result. Where respiration is embarrassed or the normal functions of the nose otherwise interfered with by fibrous overgrowths, their removal by the galvano-cautery is indicated. Knives of various shapes are required for different uses, the most generally useful being the flat blade figured below.

FIG. 8.



Cautery-knives and Handle.

There is a variety of cautery-batteries in the market, the merits of which are about equal; several forms of storage batteries are at present most popular.

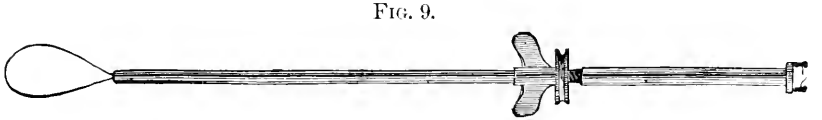
To remove a fibrous hypertrophy the turbinal is thoroughly cocainized, as for the application of chromic acid; the cautery-knife is then introduced through a suitable speculum under perfect illumination and inspection, and a shallow slit burned in the turbinated tissue. The knife must be introduced cold, and heated to a bright red when in contact with the mucous membrane by closing the circuit, when it is drawn forward, making an incision of the required length. Unless the operator is an expert and the patient perfectly controllable, it is safer to protect the septum by means of a small piece of bristol board cut to

fit and introduced before the cauterization. A thread passed through the eard and allowed to hang from the nostril assures its easy removal, which may otherwise prove to be surprisingly difficult. As a rule, there is no subsequent pain, hæmorrhage, or inflammatory reaction: if the first occurs, it is usually because either the periosteum or the septum has been burned. If slight bleeding should occur, it is easily controlled by holding a small piece of ice to the nose and keeping the head in an upright position. If for any reason the hæmorrhage should be considerable, the naris should be carefully plugged with a strip of gauze or patent lint, which in extreme cases may be dusted with tannic acid or dipped in a strong solution of the same. The immediate cause of bleeding is always the removal of the eschar, either by its being dragged off by the cautery-blade, owing to the latter being allowed to cool while in contact with the burned surface, or from some other cause. The patient should always be cautioned against forcibly blowing the nose or indulging in any form of violent exercise for at least twenty-four hours after the operation.

From one to four cautery incisions may be required to remove the occluding mass, at least two weeks being allowed to elapse between the burnings. During the interval the patient should be seen every third or fourth day and the nose treated as directed for acute coryza in its latter stages. Any inflammatory reaction or sepsis is thus prevented in most cases, and the burn heals much more rapidly than if left to run its course without further treatment.

Very large anterior hypertrophies and all posterior growths requiring operative treatment are best removed by the Jarvis snare, which is, after the cautery-blade, the most valuable instrument used in nasal surgery. Its successful use, however, demands a large amount of skill

FIG. 9.



Jarvis's Snare.

and special experience. Growths in the anterior nasal region require a full half hour for satisfactory removal, otherwise very annoying hæmorrhage is almost certain to result, while in the case of posterior hypertrophies an entire hour is required to secure a bloodless operation. The technique of snare-manipulation varies with every case, the only general rule being the very simple one that the growth is to be engaged in the wire loop, which is then to be tightened by turning the milled nut. After a firm grasp is once secured, the nut should be turned once every three to ten minutes until the mass is cut through.

Posterior new-growths can be grasped only by the aid of the rhino-

scope, the mirror being held in the left hand while the snare is manipulated through the nose by the right. There are many difficulties in the way of a successful performance of this little operation, which the space at my disposal does not permit me to describe here, and it is the writer's opinion that it should be attempted by a novice only when under the immediate direction of a skilled operator.

Myxomatous tissue, the result of degeneration of turbinated hypertrophies, frequently calls for removal in cases of chronic rhinitis. The masses may be ablated by means of the Jarvis snare, or if high up in the nasal chamber some form of biting forceps may be required. The writer's or some similar instrument may be used, small pieces being gnawed off until all myxomatous tissue is removed.

Nasal polypi (adenomata) are occasionally found in advanced cases of hypertrophic catarrh, and should be removed with the snare, the base being subsequently seared with the galvano-cautery blade to prevent recurrence. If attached far up in the nasal fossa, forceps may be required for their removal, which must always be done under full inspection, the older methods, of wrenching out polyps with the forceps, guided only by the sense of touch, being at the present day wholly inadmissible.

Deviations and ecchondroses of the nasal septum and bony outgrowths from the vomer and turbinals occur as complications in a certain proportion of cases. If they do not seriously interfere with respiration or cause unpleasant symptoms from their pressure on surrounding parts, they demand no especial treatment; but if the breathing passage is much obstructed, operative interference is necessary. The septum knife, nasal saw, dental engine, gouge, or chisel may be required, each case demanding a technique peculiar to itself. In the opinion of the writer these operations are far from being free from danger, and should only be undertaken by experienced nasal surgeons.

The constitutional management of chronic hypertrophic rhinitis is of more importance and value than is generally supposed. The gouty diathesis is the causative factor in quite a number of cases seen in private practice, and of course demands the appropriate treatment for that condition.[1] Anæmia and "neurasthenia" seem to be concomitants of nearly all severe cases of the disease, and call for therapeutic management; indeed, their removal is essential to a cure of the local lesions. Drugs which are supposed to act directly upon the nasal mucous membrane when taken internally have not given very satisfactory results in the writer's hands. Cubebs, grindelia robusta, crude petroleum, etc., while most efficient agents for impairing the digestion, give slight if any other results. Sodium bromide and ammonium chloride are, however, useful in many cases, and add considerably to the good results of

[1] See article on Gout, Volume I.

treatment; strychnine also acts well by improving the general circulation. Tonics, fresh air, regulation of diet, and hygienic surroundings are of course important, and properly-directed exercise, carried in vigorous young subjects to active sweating, has a most distinct value in all cases of chronic rhinitis.

INFLAMMATION OF THE PHARYNGEAL TONSIL.

This, with its various secondary results, is so important a complication of all forms of rhinitis that its consideration calls for a separate section.

Few symptoms are so bitterly complained of by patients as the exudation of very tenacious mucus, which occurs from inflammation of the pharyngeal tonsil during the course of a "heavy cold." The discomfort may be speedily relieved by spraying out the post-nasal space by means of the upcurved atomizer with some sedative and alkaline solution, either of the formulas suggested for simple rhinitis answering the purpose. The mucous membrane being thoroughly cleansed, it may be lightly brushed with a 40-grain solution of tannic acid in pure glycerin by means of the post-nasal applicator. The application is not altogether painless, and requires a considerable degree of manual dexterity; the utmost care must be taken not to bruise or otherwise injure the parts. Should the palate close spasmodically upon the instrument, the latter must not be forcibly removed, but the patient instructed to make some vocal sound, when the palate will relax and the cotton-carrier can be slipped out without difficulty.

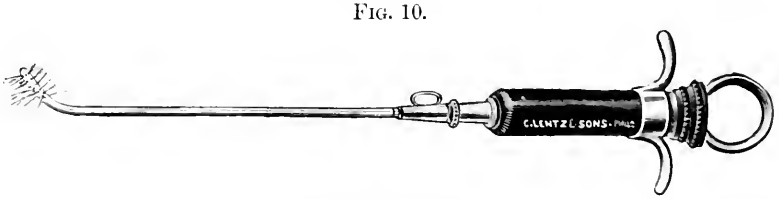
In almost all cases of hypertrophic catarrh the pharyngeal tonsil is chronically inflamed, and often enlarged. The treatment of simple inflammation of the gland has been already suggested when considering that disease. When enlargement has occurred, the applications of iodine should be made several times a week for a considerable period of time, and the strength of the solutions gradually increased. Good results may be obtained without operative interference even when the adenoid tissue somewhat encroaches on the nasal respiratory space. The tendency of these growths to disappear of their own accord must always be remembered in deciding on any radical means. Great hypertrophy of the pharyngeal tonsil, seriously interfering with the functions of the nose, may call for the use of the galvano-cautery knife, the wire snare, or some form of cutting forceps or curette. The writer regards the use of the finger in the post-nasal space, especially if the finger be armed with a cutting guard—as is suggested by several authors[1]—as

[1] See Lennox Browne, *Diseases of the Throat*, 2d ed. p. 519.

an exceedingly heroic procedure of doubtful utility. Very moderate curetting, or the biting or burning off of a few of the most prominent nodules of the tonsil, combined with the use of iodine, *and proper treatment of the whole naso-pharyngeal tract*, is sufficient in the great majority of cases. The instrument usually employed by the present contributor is a simple straight curette four and a half inches long from edge to handle, the ring well bent on the shaft and measuring five by ten millimetres. This instrument is easily introduced through the nose, is painless and safe in careful hands under cocaine anæsthesia, and will be found sufficient in all but a very few cases, in which grosser methods may be required.[1] In the case of adults the curette is guided by the aid of the post-nasal mirror, but in children the sense of touch alone must usually be relied upon. The sensations communicated to the hand through the instrument are sufficient in most cases: if absolutely necessary, the finger may be cautiously introduced behind the palate and the curette manipulated under its guidance. General anæsthesia is absolutely necessary in the latter instance, and the operation becomes a somewhat complicated and bloody one.

Very advanced stages of hypertrophic rhinitis are apt to be accompanied by atrophic and degenerative changes in the pharyngeal tonsil, resulting in crust formation in the post-nasal space, or a thick mucopus may trickle down the pharyngeal wall, both giving very great discomfort to the patient. The prognosis of this condition is very unfavorable, no form of treatment giving permanent relief; but if patients can be seen at intervals of a few weeks, palliative measures can be carried out which will secure almost perfect relief from the annoying symptoms. The post-nasal atomizer is here again of great value, and any of the solutions which will be given in the section on Sclerotic Rhinitis may be used with good result. The writer's syringe-catheter, figured below, serves a useful purpose in dislodging crusts and mucus too adherent to

FIG. 10.



Syringe-catheter.

be removed by the atomizer. It is introduced through the nose in the same manner as the ordinary Eustachian catheter, and when the posterior pharyngeal wall is reached is rotated inward and upward toward the vault: being fixed with the left hand, any chosen solution can be injected through the instrument by means of the syringe. The fine

[1] See *Transactions American Laryngological Association*, for 1889, p. 44.

jets of fluid remove masses which cannot be dislodged by any spray, and have none of the disagreeable or dangerous features of the ordinary large post-nasal syringe. The treatment must be repeated as often as the symptoms return, which is in most cases after a more considerable interval subsequent to each application.

Advanced atrophic, and sometimes ulcerative, changes occur about the region of the pharyngeal tonsil in rhinitis cirrhotica, and often cause most distressing symptoms. With our present knowledge the treatment of such conditions is exceedingly unsatisfactory, the best that can be done being to relieve the symptoms by careful antiseptic cleansing at intervals of a few days. Any of the sprays which will be given in the next section may be used, and one of the milder formulas may be given the patient to employ at home.

In all cases of disease of the pharyngeal tonsil the inflammatory condition will improve only with the general mucous membrane, and treatment of the whole upper respiratory tract is essential in nearly every instance.

SCLEROTIC RHINITIS.

Synonyms.—Atrophic catarrh, Ozæna, Rhinitis cirrhotica, Dry catarrh.

The final stages of chronic nasal inflammation, when most of the intranasal tissues have been destroyed by fibrous changes and fatty degeneration, have been very variously classified; but, as all forms overlap considerably, their therapeutic management is best considered under a single heading. In all types of either selerosis or true atrophy the prognosis is *discouragement*. New compounds frequently give relief for a certain time, and hence each of many drugs has in turn been lauded as a valuable remedy in this disease, only to be subsequently abandoned. Cases of simple selerosis, even when far advanced, can be much relieved in very many instances, but when the epithelium is permanently lost palliation is all that the modern rhinologist has to offer the unfortunate patient. The former class of cases may be much benefited by the use of "alteratives" in the form of spray: the sulpho-carbolate and the iodide of zinc, solutions of thymol or of listerine, and Boulton's solution have proved most valuable in my hands. They must be applied with skilful and thorough technique, at first daily, and toward the end of the four, ten, or fourteen months of treatment once a fortnight. More energetic stimulants are frequently called for: tincture of myrrh, sanguinaria, or galanga diluted with glycerin to suit the

individual case, are perhaps the most satisfactory. Noquet[1] recommends chloride of zinc as a most efficient stimulant. The writer prefers to use them on a small cotton mop, lightly brushing the turbinated tissues with the medicine, the use of the head-mirror and nasal dilator being essential. Mechanical stimulation by means of cautious curetting of the papillomatous turbinated mucous membrane, especially of the post-nasal region, is of undoubted value in selected cases. The straight curette used by the writer for the treatment of enlargements of the pharyngeal tonsil is the best instrument for the purpose; it must be used with the utmost care, only the diseased epithelium being scraped off.

The faradic current is probably the most useful agent we possess for treating cases of all grades of sclerosis and atrophy. A straight nasal electrode, long enough to reach the pharyngeal wall when introduced through the nose, is necessary: its tip should be well wrapped with cotton and dipped in some alkaline solution. The positive pole is to be placed in contact with the nasal mucous membrane, the negative—an ordinary sponge or metallic rheophore—being held in the hand of the patient or applied to the maxillary or laryngeal region externally. To use the battery successfully demands much care and judgment, each case being largely a rule unto itself: the only general direction possible is that the current must never be so strong as to tire or irritate the patient. The séances should not at first exceed a few minutes in length, and ten minutes is the outside limit to which the applications should be carried.

Fig. 11.

Nasal Electrode.

Operative surgical treatment is very rarely called for in nasal sclerosis. The middle turbinated body may be so enlarged as to press upon surrounding structures, in which case destruction of the superabundant tissue is indicated, chromic acid, the galvano-cautery, or the Jarvis snare being employed. Care should be taken to remove no more than is absolutely necessary to relieve pressure, the tendency of this disease progressively to destroy turbinated tissue being never lost sight of. Myxomatous changes in the middle scroll may demand the use of the biting forceps, the masses being often too sessile and elastic to be grasped by the snare; the cautery-needle is not well suited for this purpose, too much cicatricial contraction resulting from its use. The

[1] *Revue mens. de Laryng.*, 1887.

operative procedures on the nasal septum described under Hypertrophic Rhinitis may be necessary in some, but certainly in very few cases, the main efforts of treatment in this disease being to conserve, not destroy, tissue.

Where extensive atrophic changes have occurred and the ciliated epithelium has been lost, palliative measures must be carried out at short intervals to be of benefit to the patient. Any of the milder antiseptic and stimulating formulas given previously may be prescribed for daily use at home, a thoroughly good atomizer being ordered and the patient carefully instructed how to use it. Careless spraying with an imperfect instrument is quite valueless, and is very discouraging to the sufferer. After clearing the nasal chambers the mucous membrane may be protected by almost any of the bland oils which now abound in the market, albolene, glycoline, and benzoinol being probably the most perfectly unirritating. If there is much odor present, 5 grains to the ounce of menthol, oil of sassafras, or oil of cinnamon may be added to the oil, which is also to be used in an efficient atomizer. Home treatment is very easily overdone, and too much spraying is nearly as bad as none at all: the point is to keep the chambers free from crusts, and the sprays should not be used more frequently than is necessary to secure this result.

In addition to the above, thorough local treatment at the hands of the physician, carried out under the fullest illumination and inspection at intervals ranging from a few days to one or two weeks, is necessary. The mucous membrane must first be absolutely cleared by means of the anterior and posterior nasal atomizer, the syringe-catheter, or cotton tufts upon long aural applicators; in certain cases even the ear-forceps and an ordinary small rubber syringe may be required. The faradic current may then be used as directed above, and the membrane finally protected by one of the oil solutions: the appended formula is very frequently employed by the writer:

℞. Thymol., gr. iij;
Menthol., gr. v;
Albolene (liquid), f℥j.—M.
Sig. Use in atomizer.

As an alternative to the battery the whole membrane may be mopped with tincture of myrrh or galanga, slightly mitigated with glycerin, or sprayed with a watery solution of thymol or ichthyol. The thymol should never be used stronger than 3 grains to the ounce, being held in solution by the addition of a small percentage of alcohol and glycerin; even a 2-grain solution cannot be borne by some patients. Ichthyol is one of the latest remedies which has been lauded as valu-

able in atrophic catarrh; it may be used as a 1¼ per cent. solution, and is certainly useful in many cases. Its very unpleasant odor and taste are best disguised by the addition of menthol, but even so flavored it cannot be tolerated by sensitive patients. All powders, the galvano-cautery (used as a "stimulant"), and Gottstein's cotton pledgets are far worse than useless in this disease, tending to increase the chronic inflammation and epithelial destruction. Certain forms of treatment much advocated in Continental literature, such as sterilizing baths, burring away (supposedly) softened bone, scraping off degenerated mucous membrane with the finger, etc., the present writer regards as unscientific and often grossly hurtful, with the rare exception, possibly, of in a few syphilitic cases.

Laborderie[1] has reported a number of cases of great improvement following skin-grafts from the interdigital membrane of the frog to the ulcerated surfaces in rhinitis cirrhotica. Theoretically, the treatment is a highly scientific one, and could the grafts be made from a membrane covered with columnar ciliated epithelium the results might be highly satisfactory. It should be remembered that destruction of the epithelial layer is the most essential and harmful lesion of the disease, and one which has heretofore defied all forms of treatment.

Constitutional tonic treatment is more necessary in rhinitis cirrhotica than in any other form of nasal disease, and the general health must be improved by every possible means. The broad indications are the same as in the hypertrophic process, but the patients are more apt to be feeble, with imperfect circulation, and must be treated accordingly. If syphilitic infection be present, remedies directed to that disease are of the first importance, and such cases frequently do better under proper treatment than those in which no such taint is present. Chronic inflammation of the lower air-passages is present in perhaps all cases of rhinitis cirrhotica, the relief of which is of course essential to improvement in general health. Change of climate is valuable in many cases; the less elevated regions of the Adirondacks, the Maine woods, and similar "spruce-areas" are very beneficial during the summer months, and the lower highlands of the Carolinas, the plateau of Mexico about Orizaba, and the hills of Southern California are to be recommended during the winter season.

SYPHILITIC AND TUBERCULAR RHINITIS.

SPECIFIC diseases of the nose call for much the same local treatment as the simple chronic inflammations of corresponding stages, the

[1] *Le Progrès méd.*, 1887.

constitutional therapeutics being by far more important. The deep ulcerations produced by breaking-down gummata should be cauterized by acid nitrate of mercury cautiously applied on a delicate applicator; even the galvano-cautery may be used in cases of rapid necrosis. The shallow ulcers are best treated by applications of nitrate of silver, a solution of 100 grains to the ounce of distilled water being usually employed by the writer. It is essential that the raw surface be wiped clean with absorbent cotton before using the medicine. Powdered iodoform is highly recommended in the treatment of syphilitic catarrh, and may be lightly dusted over the mucous membrane by the use of the laryngeal powder-blower. In cases of rapid ulceration constitutional treatment must be pushed to the limit of tolerance, and the general health improved by every possible means. Subsequent cicatricial deformity may produce serious symptoms which call for plastic operations or other measures which cannot be described here.

Tubercular rhinitis admits of palliative measures only, which have already been described under Atrophic Catarrh, a large number of cases of the latter disease being due to tuberculosis. It is the opinion of the contributor that efficient treatment of the naso-larynx will prevent extension of the disease and indefinitely prolong life in numerous instances.

INFLAMMATION OF THE FRONTAL AND MAXILLARY SINUSES.

In nearly every case of nasal inflammation, whether acute or chronic in type, there is more or less involvement of the adjacent sinuses, the frontal, maxillary, sphenoidal, and ethmoidal all being implicated. The two last-named cavities when diseased give rise to such obscure symptoms, and are so difficult of access, that no definite treatment can be recommended. The therapeutics of the frontal sinuses are in most cases, however, equally applicable to the ethmoidal and sphenoidal. Acute hyperæmia of the brow sinus, occurring in the course of an ordinary acute coryza, calls for the treatment already recommended for the latter disease, which will usually be found sufficient to control the symptoms. Attention to the condition of the digestive tract is, of course, always called for, and a mild cathartic may be given. The bromides of potassium and sodium given in large doses, 3 to 4 drachms in the first twenty-four hours, and 2 drachms *per diem* subsequently, have often an admirable effect on this condition.

Where deformity is evident and the pain great more energetic meas-

ures will be called for. In addition to the intranasal applications, atropine sulphate internally, $\frac{1}{480}$th of a grain every hour for twelve hours, or until the throat is very dry, may be ordered. If there is decided tumefaction in the region of the cavity externally, a blister of cantharidal collodion should be placed over the frontal sinus or just above it. The symptoms may be expected to abate in twenty-four hours under this treatment, especially if the patient can be confined to the house. Without treatment even the mildest class of cases are exceedingly apt to go on to suppuration, the duration of pain and deformity occasionally being from two to three weeks.[1]

The management of pus accumulations in the frontal sinuses belongs to the domain of surgery, and will be found described in all standard textbooks on that subject.[2] Early treatment at the hands of the rhinologist will, however, prevent this unfavorable termination in nearly all cases. "Catarrhal headache" from chronic congestion of these cavities is exceedingly common in cases of hypertrophic catarrh, and usually disappears as the nasal condition improves. Severe attacks may be promptly relieved by applications of cocaine, a small ball of cotton being saturated with a 5 per cent. solution, and by means of a delicate forceps tucked up in the region of the infundibulum, being allowed to remain for from five to ten minutes. Menthol in spray form is also a useful drug in all forms of catarrhal headache, and may be used more freely than cocaine. Bromides and atropine are probably the most valuable remedies for internal administration in this condition, large doses of the sodium salt seldom failing to give relief even in the severe headaches of advanced atrophic catarrh. Jurasz[3] advocates the use of a delicate probe for opening the infundibulum in cases of purulent inflammation of the frontal sinus, but the operation is one of very great difficulty, and, in the writer's opinion, of doubtful utility. Possibly medicated fluids might be introduced into the cavity by means of a delicate silver cannula passed in the same manner as the Jurasz probe.

PURULENT INFLAMMATION OF THE MAXILLARY SINUS.

This is not a very common condition in nasal catarrh, the disease being more frequently due to dental caries and alveolar abscesses. When dependent on the latter causes, the removal of the offending tooth and thorough drainage of the antrum by drilling through the

[1] See paper on this subject by the writer, *Medical News*, Jan. 5, 1889.

[2] See R. A. Reeve, *Canadian Practitioner*, 1887. [3] *Berlin. klin. Woch.*, 1887.

alveolar socket into the sinus are advocated. Various antiseptics may be subsequently injected into the sinus through the opening thus made. Purulent catarrh of the antrum, occurring as a sequel of acute or chronic rhinitis, rarely calls, however, for such vigorous measures. Many cases will get well without special treatment if the nasal lesions can be cured, and even severe examples will wholly recover without operative interference in many instances. The writer believes that fluids can be made to enter the maxillary sinus through its normal opening into the nasal chamber in most instances in which it is diseased, and that such treatment with properly chosen solutions will cure very many cases which have heretofore been subjected to operation. All swellings which interfere with drainage from the antrum must first be removed, temporarily by cocaine, or permanently by chromic acid or galvano-cautery "tackings." The patient is then instructed to lean the head toward the shoulder corresponding to the affected side, and an atomizer throwing a strong, coarse spray is introduced through the nasal speculum and pointed as nearly as may be at the opening of the sinus into the middle meatus. The spray may then be thrown into the nasal chamber with some force and for as great a length of time as the patient can bear it without much discomfort. The head is then leaned forward and the surplus fluid allowed to drain off, the spraying being then repeated two or three times, as may seem desirable. Several weeks of daily or tri-weekly treatments may be required, but convalescence is scarcely more prolonged than after operative interference, often much less so, and the patient is saved much pain and annoyance. Any non-irritating antiseptic solution may be used for the purpose, the peroxide of hydrogen being especially recommended by Ingalls and others; the appended formula is a favorite with rhinologists:

℞.	Listerine (Lambert),	f℥v ;
	Acidi borici,	gr. xxx ;
	Sodii boratis,	gr. viij ;
	Aquæ rosæ,	f℥ij ;
	Aquæ dest.,	q. s. ad f℥iv.—M.
Sig.	Use in atomizer.	

Opening the antrum from the middle or inferior meatus, as advocated by Mickuliez and others, must be considered an heroic procedure, to be undertaken with great reluctance even by an expert; extraction of a tooth, as previously suggested, is probably a much safer and simpler operation.

It is of course of great importance in all cases of disease of the maxillary sinus consequent to nasal inflammation that the nose should receive the most careful attention, and be brought to as near a condition

of normality as may be possible. Tumors and polypi of the antrum belong, like those found in the nasal cavities, to the province of surgery, and cannot be considered here.

ANOSMIA.

Anosmia and other derangements of the sense of smell offer little encouragement to the nasal therapeutist. When dependent on affections of the respiratory portion of the tract, relief of the former will often restore the lost sense, but when due to disease of the olfactory region or to central lesions, little or nothing can be done in most cases. The constant galvanic current is recommended by Spencer Watson, or faradism may be employed: Morell Mackenzie advocates insufflations of strychnine, $\frac{1}{24}$ grain in 2 grains of powdered starch representing a local dose. Syphilitic patients may be improved by specific treatment internally, and progressive doses of strychnine may be tried in almost all cases. When central or nerve-lesions are the causative factors, the therapeutic management must be directed to these conditions, the prognosis, however, not being favorable. Parosmia, or subjective derangement of olfaction, occurs in epilepsy and other nervous diseases, and its treatment belongs rather to the province of the neurologist than to that of the nasal therapeutist.

DISEASES OF THE PHARYNX AND LARYNX.

By CHARLES E SAJOUS, M. D.

The fact that the subjects treated of in this article include many that are seldom met with in general practice has led the writer to introduce, in a few instances, a brief description of their etiology and symptomatology. This departure from the general plan of the work has been made in order to carry out better its object in the practical sense, and avoid the necessity of research when time is precious. This is the more necessary since the subjects alluded to are within the territory of a specialty, the knowledge involved being hardly of a kind expected in the general practitioner, for whose benefit this article is principally written.

The lines of treatment indicated are those supported by clinical experience—a selection worthy of the reader's confidence. Had promiscuous therapeutical observations been noticed, the entire volume would hardly have sufficed, and much confusion would have ensued. The recent methods which have been alluded to have been selected from among those presenting reasonable indications that they would not very soon be relegated to oblivion.

DISEASES OF THE UVULA.

Uvulitis.

Although inflammation of the uvula without involvement of the pharynx is seldom seen, it nevertheless may occur as a result of continued and forcible hacking to dislodge accumulated mucus in the pharyngeal vault, of traumatism, or as a local manifestation of a diathetic disorder. The uvula suddenly becomes red and swollen, giving rise to pain during the act of deglutition, and to an irritating cough when the infiltration of the tissues is such as to cause elongation of the organ.

The local application of a 20 per cent. solution of hydrochlorate

of cocaine with a camel's-hair pencil every two hours arrests the unpleasant symptoms, by contracting the tissues and depleting them. In case of inability on the part of the patient to carry out this treatment properly, a lozenge composed of $\frac{1}{6}$ grain of cocaine and 2 grains of powered coca-leaves may be substituted. Scarification may be practised with advantage when the congestion is marked. The parts around the uvula being thoroughly anæsthetized with a 10 per cent. solution of cocaine, a tea-spoon, held in the left hand, is passed behind the organ, the hollow surface of the bowl serving as a support for it and as a shield for the pharyngeal wall. A bistoury is then used to prick the inflamed surfaces a few times, bleeding being encouraged by gargling with lukewarm water.

Elongation of the Uvula.

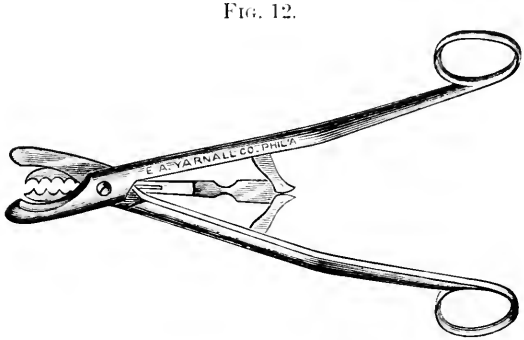
Elongation of the uvula occurs in the majority of cases as a result of chronic catarrhal affections of the posterior nasal cavity and of the pharynx. It is not so much due to extension of the inflammatory process proper as to the irritation induced by the constant hacking and scraping to which catarrhal cases usually become accustomed, and to the additional irritation of passing discharges. General weakness and anæmia through loss of muscular tone may also allow the soft palate to droop on the tongue, thus simulating true elongation of the uvula and giving rise to the same symptoms. Gastric and hepatic disorders, by disturbing the equipoise of the circulation, may maintain a pharyngeal congestion capable of involving the soft palate and uvula, and induce elongation of the latter. Disorders liable to cause paralysis, as diphtheria and scarlatina, may also become etiological factors, and, by causing depression of the soft palate, at least simulate an elongation as complete in symptomatic expression as that due to inflammatory processes.

The elongation may be temporary, and may follow the course of an acute pharyngeal congestion, the uvula becoming at times œdematous and much enlarged. In such cases the treatment adopted for the reduction of the inflammatory process is usually sufficient to restore the uvula to its normal state. Much assistance may be obtained, it may be added, in the treatment of these cases by scarifying the organ. Snipping off a small piece at the end, as recommended by some authors, while relieving much the existing infiltration, is hardly warranted, delaying as it does the final recovery until the cut surface has completely healed.

When the elongation is unaccompanied by active inflammation, or, in other words, is present when its own and the surrounding tissues are not congested, medication is useless. Temporary contraction may be obtained by means of strong astringents, such as tannin, sulphate

of copper, etc., but such treatment merely deludes the patient, who soon returns as badly off as before. Shortening by removal of a piece *representing the extent of the elongation* is the only effective measure, and is sometimes followed by results as surprising to the patient as they are gratifying to the surgeon.[1] The operation may be accomplished with a pair of long curved scissors, the uvula being steadied with a pair of suitable forceps. This procedure, although apparently easy, is at times quite difficult, owing to the constant up-and-down motion of the uvula. Again, the scissors, in closing, allows the organ to slip out of its grasp after cutting perhaps half way through it. A much more satisfactory method is that by the use of the scissors shown in the accompanying figure:

FIG. 12.



Sajous's Uvula Scissors.

The instrument being held with the palm of the hand directed toward the operator—that is to say, with the thumb and finger passed through the rings from below upward (the bend being just sufficient to prevent interference with the line of vision)—it is introduced closed into the mouth. As soon as the point has reached the uvula the rings are separated, and the organ hangs between the teeth of the claws. The rings being now approximated, the claws close on the uvula *before* the blades touch it (a feature possessed by no other uvula scissors), hold it fast, and bring it forward by bending it at its base. The scissors cutting it in that position, the cut surface is *oblique* and posterior. When food is swallowed the horizontal surface obtained with other instruments is scraped and kept sore for several days by the passing food. With the oblique surface facing posteriorly, obtained with this instrument the bolus only touches the anterior surface of the stump, the cut surface resting against the pharynx, and therefore out of the way of the passing foreign substances. The healing process is more rapid; a

[1] Many cases presenting all the physical symptoms of catarrhal phthisis have been suddenly cured by the removal of a greatly-elongated uvula, which by irritating the larynx caused exhausting cough. Two such cases have been observed by the writer.

better stump is obtained; slipping of the uvula between the blades is impossible; and the cut is always complete. A 20 per cent. solution of cocaine, applied four minutes before the operation, renders it painless and prevents the slight bleeding which otherwise usually occurs.

An after-effect of the operation is slight local pain, increased by the act of deglutition. Well-seasoned food, hot liquids, and smoking should be avoided. A lozenge containing $\frac{1}{12}$ of a grain of cocaine and 2 grains of powdered leaves of coca, allowed to dissolve slowly in the mouth, greatly alleviates the slight pain present.

As a rule, too much of the organ is removed, and cases in which no trace of it is left are not uncommon. It is true that the soft palate seems to accommodate itself to the malformation resulting from bad surgery by performing more or less accurately the functions of the absent organ, but, nevertheless, cases have been met with in which these functions are imperfectly performed, owing to inability on the part of the soft palate to close completely the naso-oral isthmus during deglutition. As much should be left of the organ as would about represent a normal one. The stump assumes a rounded shape, and enough of the azygos uvulæ is always left to meet all physiological requirements.

Tumors of the Uvula.

Papillomata, occurring in the majority of cases as a manifestation of tuberculosis or syphilis, are occasionally observed on the uvula. Other forms of tumor, cysts,[1] and angiomata[2] are also met with, though very rarely. Extravasation of blood into the uvula,[3] giving it a club-shaped appearance, and due to contusions through unskilful handling of instruments, may simulate an angioma.

Tuberculous growths are best overcome by means of lactic acid applied to the surface left after excising the body of the tumor with the scissors. The application may be made with a camel's-hair pencil, care being taken to avoid dripping. It should be repeated daily until complete resolution has taken place. For syphilitic growths nitrate of silver should be substituted for the lactic acid, the preferable mode of application being that involving the use of the probe. The tip of the instrument, being heated over a lamp, is then applied against a crystal of the salt, which at once dissolves and closely adapts itself to the metallic surface in cooling. On contact with the wound the nitrate of silver again deliquesces. Care should be taken to include all parts of the diseased surface in the application, which should be repeated as soon as the whitish scab formed has disappeared.

In the other forms of tumor, chromic acid, used in the same man-

[1] Two personal observations, among others.

[2] Chipault, *Revue mensuelle des Maladies de l'Enfance*, June, 1890.

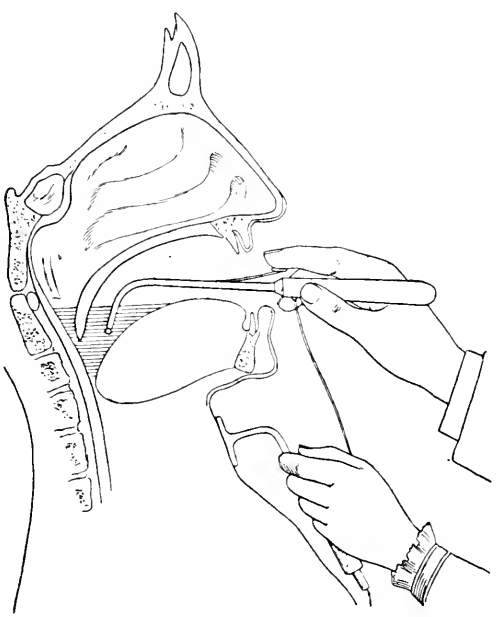
[3] Schech, *Diseases of the Mouth, Throat, and Nose*.

ner as the nitrate of silver, described above, is of service in the removal of small soft and sessile growths. When opportunity is furnished by pedunculation either to snare or snip the neoplasm off, it is always best to take advantage of it, thus greatly promoting the chances of early resolution, and also limiting to a marked degree unpleasant secondary symptoms, such as local inflammation and pain. The galvano-cautery is an efficient agent in the treatment of diminutive and non-inflammatory growths, a bright cherry heat being the most effective.

Neuroses of the Uvula.

Paralysis.—Paralysis of the uvula is usually associated with corresponding affections of the palate, resulting in their turn from general affections; diphtheria, for instance, is a prolific cause. The palate remains motionless during deglutition or other acts normally requiring its elevation or approximation to the pharyngeal wall, this symptom being present in addition to any of the symptoms usually accompanying elongation. In cases of paralysis, both general and local treatment

Fig. 13.



is indicated, arsenic in the form of Fowler's solution being administered in increasing doses, beginning with 3 drops three times daily, taken in half a tumblerful of water immediately after meals. The faradic current is by far the best form of electrical stimulation obtain-

able. It may be applied directly to the palate by means of a laryngeal electrode of the form shown in the cut (Fig. 13), or better still through water held in the mouth by the patient by simply bending the head backward as shown in the figure. The negative pole is connected with the mouth electrode, while the positive is connected with that used externally, over the thyroid cartilage. The current should be very mild at first, and gradually increased with the patient's ability to stand it. One mouthful of water is held in the mouth as long as he can hold his breath, when another mouthful is taken. The external or neck electrode should be kept moist during the application to ensure penetration of the tissues by the current. The sittings should not last more than ten minutes, but be repeated daily. This method, which the author has not seen described elsewhere, ensures thoroughness of application; every part of the soft palate is reached, and, contact between the mucous membrane and the metallic surface being avoided, the faradization can be continued much longer without discomfort to the patient.

Rosenzweig[1] indorses the treatment proposed by Henoch, which consists in injections of strychnine, $\frac{1}{32}$ to $\frac{1}{20}$ of a grain daily, the neck being the seat of injection. Recovery took place in from three to nineteen days in the cases reported.

Reflex Neuroses.—Neuroses of the soft palate and uvula may also be dependent upon reflex irritation. Schadle[2] of St. Paul, Minn., observed an interesting case in which rapid spasmodic raising and lowering of the parts occurred as a result of hypertrophy and hyperæsthesia of the mucous membrane covering the turbinated bodies, and which disappeared as soon as the latter were thoroughly cauterized. Cases of the same kind, but less clearly defined as to etiology, were recently added to the literature of the subject by Dieulafoy[3] and Legroux.[4]

DISEASES OF THE PHARYNX.

Acute Pharyngitis.

Although acute pharyngitis may occur as a manifestation or concomitant symptom of many disorders, the early appearances of the pharynx do not vary sufficiently to render very trustworthy a diagnosis established solely upon local examination. The pharynx usually presents irregularly distributed redness, patches of congestion implicating, in the majority of cases, the posterior pillars. In severe cases the anterior pillars, the uvula, and the tonsils are also involved, the redness being

[1] *Therapeutische Monatsh.*, April, 1891.
[2] *Journal Am. Med. Association*, Oct. 20, 1888.
[3] *La Semaine médicale*, Nov. 12, 1890.
[4] *Ibid.*, Nov. 26, 1890.

greater and more evenly distributed. The general symptoms, if any are present, usually indicate a marked case; a feeling of lassitude, headache, and slight increase in the superficial temperature being the usual train of sensations experienced. The treatment should consist of two distinct parts—the first tending to abate the local symptoms by direct treatment, the second consisting of measures calculated to combat the disorder acting as exciting cause.

Whatever be the origin of the affection, the local measures are always of service, the aim being to deplete the engorged blood-vessels and the infiltrated tissues. Cocaine would be an ideal remedy in these cases were its effects more lasting and the reaction following its use (owing to temporary paresis of the blood-vessels) not undesirable. Better than cocaine is 40-grains-to-the-ounce solution of nitrate of silver, which, applied once a day with a large camel's-hair pencil (carefully avoiding dropping into the larynx), after drying the pharyngeal walls with an absorbent cotton pledget, not only produces the desired effect upon the tissues, but anæsthetizes them sufficiently to arrest the local pain, which at times is quite severe, especially when the act of swallowing is performed. A weaker solution of nitrate of silver would be irritating instead of palliative. A lozenge containing $\frac{1}{10}$ of a grain of cocaine, 1 grain of borate of sodium, and 1 grain of chlorate of potassium, dissolved in the mouth every two hours, greatly assists the preliminary procedure. Tannin dissolved in glycerin, 40 grains to the ounce of the latter, serves a good purpose, in children especially, but it should be applied with a cotton pledget at least three times daily to bring about any result. A very effective treatment, when local applications cannot be practised and when the patient can remain at home, is the inhalation of the vapor of water charged with the fumes of benzoin. One drachm of the tincture being placed in a tea-cupful of very hot water, the cup is covered with a towel folded into a cone; the mouth being then placed over the upper opening, the steam evolved is inhaled as long as it is generated. Lozenges containing 3 grains of the resin of guaiac, as recommended by Morell Mackenzie,[1] may be substituted when the patient is obliged to go out of doors. Another method of real value is that recommended by Concato and Bufalini,[2] consisting in spraying the pharynx with ether every two hours for three or four minutes.

Of great importance in the treatment of acute pharyngitis is a proper recognition of the influence exercised by disorders of neighboring parts in maintaining the pharyngeal inflammatory process in a state of activity. Intranasal disease, it must always be borne in mind, is one of the most prolific causes of pharyngitis, and measures addressed to

[1] *Diseases of the Pharynx, Larynx, and Trachea*, London, 1880.

[2] Schech, *Diseases of the Mouth, Throat, and Nose*, Blaikie's translation.

the nasal cavities, anterior or posterior, should form one of the most important elements of the curative method adopted. In fact, this is so true that the pharyngeal disorder will often be observed to fluctuate with the changes noted in the nasal affection. The treatment of the latter does not belong to this section, but it will not be out of place to state that absolute cleanliness of the nasal organs, maintained by the bi-daily use of a wash consisting of 1 drachm of bicarbonate of sodium dissolved in a pint of lukewarm water and snuffed into the nose from the palm of the hand, will actively influence recovery if carried out with the measures already recommended.

Hepatic engorgement is the cause of often-repeated attacks in a small proportion of the cases, and if this tendency to frequent recurrence exist and the nose be normal, the liver will generally be found to form the basis of the trouble, the local treatment becoming in that case of secondary importance. A saline purgative is here of infinite value, followed by the administration of phosphate of sodium, two tea-spoonfuls night and morning, to stimulate the liver gently until its normal activity is restored. A pill composed of calomel 3 grains and extract of belladonna $\frac{1}{4}$ of a grain, taken at night until copious evacuations have been obtained, is another means usually followed with prompt results.

Catarrhal gastritis is a frequently observed etiological factor in over-eaters and tipplers. These cases are often unsatisfactory, owing to the difficulty experienced in obtaining a change in their habits. Copious draughts of hot water, sipped night and morning, with bismuth, 10 grains before meals, and an occasional purgative, seem to do all the good that can be expected. When the physician's wishes as to a modification of habits are complied with, the patients soon recover completely, especially if local treatment is added to the systemic measures adopted.

In a small proportion of cases the pharyngeal affection is associated with the manifestations of a general diathesis, such as rheumatism and gout, muscular and articular pains being quite evident reminders of the existence of this association. Salicylate of sodium, 15 grains every three hours, actively modifies the whole train of symptoms, very often after three or four doses only have been taken.

Membranous Pharyngitis.

This is a rather more severe pharyngeal disorder than the preceding, also consisting of an acute superficial inflammation, but characterized by the exudation of a whitish substance or false membrane, and often mistaken for diphtheria. The early subjective symptoms of both diseases also present much analogy. The septic character of membranous pharyngitis is distinctly shown by the results of a treatment based

mainly upon this hypothesis, supplemented with general tonics, the disease being usually met with in persons weak in health and ill able to withstand the proximity of affections such as diphtheria, scarlatina, etc. or other infectious diseases. A solution of permanganate of potassium, 10 grains to the ounce, is an effective agent to check the local trouble. It should be applied with a camel's-hair pencil every two hours over the inflamed parts, after carefully cleansing them of all false membrane by means of a pledget of cotton fastened to the end of a probe. A mild aperient, the salines being preferable, is always of value in these cases. Salol is highly recommended by Gouguenheim[1] of Paris; but it must be administered in large doses—1 drachm three or four times a day, supplemented with a spray of boric-acid solution, the diet being confined meanwhile to milk.

Boislimiere[2] of St. Louis employed the following formula in a large number of cases, and obtained recovery in from twelve to thirty-six hours—a great gain in time, as the average duration of the affection is from two to five days:

℞. Sodii benzoatis, ʒj to iv;
Glycerini,
Elixir. calisayæ, āā. f℥j.—M.
Sig. One tea-spoonful every one or two hours.

The severe dysphagia often present renders necessary the exhibition of anodynes. The remedies indicated for the same purpose in acute pharyngitis will serve advantageously in the membranous form.

As tonics the preparations of cinchona, arsenic, and strychnine are of especial value. When slight stimulation is necessary—it is generally requisite in asthenic cases—the Mariani wine of coca is by far the most effective agent, a wine-glassful to be taken one hour after meals.

Follicular Pharyngitis.

This form of pharyngitis, commonly termed "clergyman's sore throat," is most prevalent among persons who in their avocations are obliged to use the voice extensively—preachers, lawyers, singers, army officers, etc. The principal pathological conditions characterizing it, in addition to the vascular engorgement of chronic pharyngitis, are the presence of a number, more or less great, of rounded projections, reddish in color, with white apices, standing out like pimples from the surface of the membrane.

The treatment of follicular pharyngitis includes, besides the gene-

[1] *Annales des Maladies de l'Oreille, du Larynx, du Nez et du Pharynx*, Sept., 1890.

[2] *St. Louis Courier of Medicine*, Feb., 1888; ref. in *Annual of Universal Med. Sciences*, series 1889.

ral and local measures indicated for simple acute pharyngitis, surgical procedures for the active destruction of the inflamed follicles, the main foci of inflammation. Galvano-cautery has given by far the best results. Besides being a painless means, it gives rise to no disagreeable after-symptoms and does its work effectually. A small loop twisted at the end, so as to form a miniature cork-screw, is the most satisfactory electrode: it penetrates deeply into the inflamed follicle, and gives rise to no secondary disturbance, especially if the tip be brought to a bright cherry heat. Each engorged follicle should be touched after carefully cleansing the pharyngeal wall with an alkaline spray. Not more than four or five follicles should be burned at each sitting, several days being allowed to elapse before another series of cauterizations is attempted. Hardly any discomfort is caused during the operation, slight local soreness, lasting a couple of days, representing about all the after-effects that occur. With the destruction of the follicles disappears the surrounding inflammation, and almost immediate relief ensues. When the superficial vessels are large and show evidences of varicosity, the larger ones should also be cauterized, the tip being applied a couple of times along the portion showing through the membrane.

When a galvano-cautery battery cannot be had, actual cautery may be substituted, although it offers by no means the same certainty of a favorable result. A good-sized piece of wire, mounted upon a wooden handle, is heated to a red heat in the flame of an alcohol lamp and applied to each follicle, the manipulation being conducted rapidly to avoid cooling of the wire during its excursion between the lamp and the pharynx. The after-effects of the applications are the same as those following galvano-cautery, unless the flame of an oil lamp or gas be employed, when the carbonaceous deposit formed at the end of the wire may greatly retard resolution of the cauterized spots by introducing into the wound irritating particles of lampblack.

Nitrate-of-silver cauterizations are much less effective than either of the two preceding. An instrument such as that used for actual cautery may be employed. Its tip being heated over an alcohol lamp, it is applied against the nitrate-of-silver crystal, enough of which will adhere for the cauterization of two follicles. Resolution does not take place as rapidly as when the other methods are used, and more time should elapse between the sittings.

The follicles once destroyed, treatment for the chronic inflammation existing in the membrane proper should be continued until the normal color of the pharynx returns.

Pharyngo-mycosis.

The white or yellowish deposits characterizing this affection, and

usually found in the crypts and folds of the tonsils, must be removed with a small curette, each cavity being thoroughly emptied. At times the base of the tongue and projections of mucous membrane may become more or less covered with them, adding greatly to the fetidity of the breath. The origin of the *Leptothrix buccalis* being generally due to carious teeth, treatment of the latter is of first importance. The tartar at the base of the teeth being also a prolific field for the *Leptothrix buccalis*, the patient should be advised to cleanse his mouth and teeth carefully at least once a day. Bryson Delavan[1] recommends a solution of mercury bichloride, 1 : 2000, applied to each crypt after cleansing. Nitrate of silver dissolved by heat on the end of a probe is also quite effectual, while galvano-cautery may be considered as the most satisfactory agent to prevent recurrence of the disease. Bogroff of Odessa[2] recommends fuchsin in saturated solution, mixed with a 1 : 1000 solution of corrosive sublimate.

Dry Pharyngitis.

Dry pharyngitis, also termed atrophic pharyngitis, generally finds its origin in a long-standing post-nasal catarrh and as a sequel of chronic or follicular pharyngitis. Its remote cause may therefore be traced to all the etiological factors entering into the production of these affections. In old people it frequently occurs as a manifestation of senile debility. Its principal feature is the absence of lubrication due to the deficient glandular action, and as a result the membrane appears dry and lustrous, with perhaps streaks of muco-purulent post-nasal discharge adhering tenaciously to its surface. The membrane becomes sometimes greatly thinned, and occasionally cases are met with in which this reduction in thickness causes the conformation of the vertebræ lying behind the membrane to be distinctly seen.

In young people dry pharyngitis can generally be cured, but in the aged such a result is seldom obtained. Of primary importance in the treatment of this affection is cleanliness of the naso-pharynx and pharynx, to limit as much as possible one of the existing causes of the inflammatory process—contact with the naso-pharyngeal secretions, which are almost always extremely irritating. Chlorate of potassium, 1 drachm to the pint of lukewarm water, inhaled into the nose from the palm of the hand and allowed to pass into the mouth by tilting the head backward, meets the indications more satisfactorily than other agents, owing to its tendency to maintain the parts in a moist condition. The trouble being frequently kept up by the inhalation of dust and other irritating substances, by sleeping with the mouth open, etc., careful examination to ascertain the presence of any such irritating cause should

[1] *Annual of the Universal Medical Sciences*, vol. iv. p. 285, series 1888.

[2] *British Med. Journal*, Aug. 15, 1891, from *Vratch*, No. 16, p. 411, 1891.

be made. Of greatest value in these cases is the application of electricity, suggested by Shurly of Detroit some years ago. Instead, however, of galvanism, which he recommends, the writer uses faradism, the negative pole being applied to the pharynx. The method of application is that described and illustrated on p. 443. Daily sittings are necessary for about two weeks, then every other day, after which they can gradually be diminished in number. The only drug found to have a favorable influence upon the atrophied membrane is nitrate of silver (10 grains to the ounce of water), which, applied with a cotton pledget every other day, produces marked relief in almost all the cases treated. Too stimulating a remedy should be avoided, the resulting inflammation being more harmful than beneficial. Oleoresin of cubebs, 15 drops, taken on a lump of sugar three times daily, is of value until it begins to disorder the stomach. Systemic disturbances, principally those of the digestive apparatus, contribute greatly to the continuance of the trouble, and should be carefully sought after and corrected.

Tuberculous Pharyngitis.

Tuberculosis of the pharynx generally presents itself as a complication of pulmonary or laryngeal tuberculosis, or of both, rarely preceding them. Much can be done to alleviate the intense suffering to which it gives rise, especially during the act of deglutition, but a cure can hardly be hoped for unless the local trouble be absolutely primary and the case be seen early.

Touching each shallow grayish ulcer with a 20 per cent. solution of cocaine, and, as suggested by Krause of Berlin and Heryng of Warsaw, scraping it thoroughly with a curette, and then applying to each scraped spot lactic acid, gives very satisfactory results when the ulcers are not too deep. As a rule, however, the application of anything but sedative agents causes great pain, and seldom does much good. Of the sedatives, cocaine is certainly the most effective and seems at times to promote resolution. Lozenges are not an advantageous form for its application, owing to the frequent necessity of swallowing induced. It is best to familiarize an attendant with the use of a camel's-hair pencil, and to instruct him to touch the spots of ulceration whenever pain is present. After each application iodoform should be spread over the ulcers also (using another camel's-hair pencil to do this), and the patient be requested to keep the mouth open for a couple of minutes. This treatment, repeated several times daily, is very soothing to the parts, and often yields very satisfactory results. Iodoform is not as disagreeable to the taste as it is to the sense of smell. Soft and lukewarm food and but slightly seasoned will soon be found to cause the least pain. Morphine, belladonna, and all drugs causing

dryness of the throat when administered internally should be strictly avoided, the dryness greatly increasing the suffering.

Syphilitic Pharyngitis.

The three stages of syphilis may become manifest in the pharynx. Primary syphilis is rarely met with, and its local manifestations, corresponding with those of the other parts of the oral cavity, either disappear spontaneously or yield to the application of nitrate of silver fused to the end of a probe. In the secondary form a solution of nitrate of silver (30 grains to the ounce) gives greater satisfaction than the solid stick; it should be applied with a camel's-hair pencil to each blotch after thorough cleansing with an alkaline solution. Internally, the red iodide of mercury should be given in doses of $\frac{1}{16}$ of a grain three times a day, and be continued until the first evidences of ptyalism occur, when a course of iodide of potassium, administered as indicated below, will be of service to eliminate the mercury from the system. While this treatment is being conducted the teeth should be kept scrupulously clean, and mouth-washes containing either borax or chlorate of potassium be frequently used. These precautions, besides contributing to the patient's comfort, influence markedly the spread of the local manifestations. The general health should be looked to with care, and tonic and nutritive preparations administered. Cod-liver oil and malt or cod-liver oil emulsion serve a useful purpose in both the second and third stages. The use of alcoholics and smoking should, however, be strictly interdicted. They both tend to greatly aggravate the ulcerative process. The food should be non-irritating as to the condiments, and not be taken hot. Frequent bathing is always advantageous.

In the tertiary form iodide of potassium is much more effective than mercury. Beginning with 10 grains three times a day, 1 grain is added to each dose until 40 grains are taken at a time. Iodism generally supervenes when the half of that quantity is taken, but it is not disadvantageous to continue the administration of the iodide notwithstanding the eruption and the coryza. These unpleasant complications can quickly be mastered by the use of Fowler's solution, 3 to 5 drops after each dose of the iodide. The continuation of the iodide should depend upon the effect produced, and as soon as evidence appears that the remedy is mastering the disease the dose should be decreased as it was increased, one grain at a time. In some cases iodide of potassium deranges the stomach. This usually occurs when it is given dissolved in a small quantity of excipient. If each dose is administered, however, in a large tumblerful of pure water, these evil effects will be avoided.

The local treatment, as in all other specific ulcerations, becomes

much more effective if the parts are kept in the cleanest possible state. This may be done by the patient himself by means of gargling, detergent washes containing borate of sodium, bicarbonate of sodium, or chlorate of potassium being employed. One drachm of either dissolved in 1 pint of water forms a solution that may easily be prepared by the patient. Every other day the ulceration should be touched with nitrate of silver in the manner already explained. Pain during deglutition is usually the most severe symptom. Most effective in overcoming this very distressing feature of the local manifestations is of course cocaine in the form of a 10 per cent. solution. It can be used as a spray, the patient being advised to use the atomizer only sufficiently long to enable him to feel the moisture over pharyngeal surfaces. If the spray is used four or five minutes before meals, the patient will be able to partake of much more food than he otherwise would—an important element in the ultimate results of the treatment.

Adhesion of the soft palate to the pharynx and other deformities sometimes follow syphilitic ulceration in this region. Operative procedures then become necessary to restore the parts to a condition approximating the normal as much as possible as to conformation and function.

Erysipelas of the Pharynx.

As in erysipelas of other portions of the system, measures to support the patient and to abate the fever are of primary importance. The efflorescence of the affection is preceded by a well-marked febrile stage, which lasts two or three days, and during which the temperature may surpass 103° F. As soon as the erysipelatous blush appears, however, this high temperature tends to decline, again to reach its height as soon as the eruption has thoroughly developed. Veratrum viride, recommended by many authors, is in the writer's opinion too depressing. Aconite in small doses frequently repeated serves the same purpose, without presenting this untoward feature. It may be conveniently administered with the tincture of the chloride of iron, one advantage of which is that it limits the local manifestation by its astringent action as it passes the inflamed surfaces on its way to the stomach. The following prescription serves the purpose satisfactorily:

R.	Tinct. aconiti,	♏x;
	Tinct. ferri chloridi,	ʒij;
	Glycerini,	ʒss;
	Aquæ,	q. s. ad ʒiij.

Sig. One tea-spoonful to be taken every half hour until temperature and pulse are influenced; afterward every hour.

The erysipelatous blush is bathed with the mixture during the act of deglutition, and remains under the influence of the astringent until the next dose is taken. The continuous action which is thus obtained greatly limits the duration of the local inflammatory process.

Bedford Brown[1] insists upon the importance of counter-irritation applied to the neck and chest "for the purpose of inducing a migration of the inflammation." Although the writer has not as yet acted upon this recommendation—most probably a valuable one—he would be inclined to choose the region of the liver as the seat of counter-irritation, basing this selection upon the remarkable results obtained by the same procedure in the treatment of epi-taxis, and which no other region of the body seems to furnish.

The local pain may easily be mastered by means of a 10 per cent. solution of cocaine, the excipient used being mint-water. The headache, usually quite marked, can be greatly benefited by snuffling $\frac{1}{8}$ grain of morphine every two or three hours. The opiate is absorbed by the nasal mucous membrane, and taken in this way is more effective in headache than if taken by the mouth. Cold compresses may be employed in addition with advantage. The morphine should not be continued too long, lest it cause constipation. The bowels, on the contrary, should be kept free by means of salines, Hunyadi Janos water, etc.

The diet should consist of soft food, milk and its preparations being of special advantage. Alcoholic beverages are irritating to the local lesion on their passage to the stomach, but they may be administered, should stimulants be required, by means of soft gelatin capsules, slightly moistened before placing them in the patient's mouth.

Retro-pharyngeal Abscess.

The fact that retro-pharyngeal abscess is almost always met with in children renders an early diagnosis more difficult, and proportionately decreases the chances of success when efforts are made to arrest progress before pus is formed. If fluctuation be not present, however, the administration of iodide of potassium in full doses, coupled with the frequent local application by means of a camel's-hair pencil of a solution of iodine in glycerin (10 drops of the tincture to the ounce of glycerin), often succeeds in arresting the development of the abscess. The case should be watched, however, owing to the tendency of the iodide of potassium to cause œdema. Should infiltration of the tissues of the pharynx appear, the drug should be stopped and the infiltration reduced by the application of a 10 per cent. solution of cocaine, repeated every hour until all signs of it have disappeared.

When the abscess is found to contain pus the only treatment is

[1] *Journal of the Am. Med. Association*, quoted in *Annual of the Universal Med. Sciences*, series 1888.

evacuation by freely opening it with a bistoury or by means of a trocar and aspirator. The former is the quicker method, but it exposes the patient to suffocation by the flow into the larynx of the pus suddenly liberated. The least dangerous mode of procedure is that proposed by MacCoy of Philadelphia. A small vertical incision is made at the upper portion of the swelling, above the point of greatest tension, to relieve the latter. After the flow of a small quantity of pus, the tension will be found to have been relieved, and the incision can be extended with less danger, the abscess being then gradually emptied by digital compression. As soon as the cut in the abscess shall have been made, the patient's head should suddenly be tilted forward, to cause as much of the pus as possible to flow out of the mouth. The discharge continues for some time, the cavity growing smaller and smaller until the wound closes.

When the aspirator is employed a curved trocar should be used, and its point inserted upward into the most prominent portion of the growth. This is the simplest and least dangerous operation, and may be made painless by the preliminary application, with a camel's-hair pencil, over the seat of the abscess, of a 10 per cent. solution of cocaine. The general health of the patient should be carefully looked into, and adequate means employed to correct any systemic disorder that may be discovered. A scrofulous diathesis is present in almost all idiopathic cases, which represent at least 90 per cent. of the total number. Retro-pharyngeal abscess is an occasional complication of scarlet fever and of cervical spondylitis. This, however, in no way modifies the form of treatment recommended.

Tumors of the Pharynx.

Epitheliomata, sarcomata, fibro-sarcomata, osteomata, adenomata, papillomata, cysts, adeno-chondromata, and pilose tumors have been observed in the pharyngeal cavity. Removal may be effected in some cases by electrolysis, the snare, or galvano-cautery. Malignant tumors, however, should be removed bodily. This subject comes within the scope of treatises on surgery, to which the reader must be referred.

Neuroses of the Pharynx.

Hyperæsthesia.—Hyperæsthesia frequently follows local manifestations of infectious diseases, the exciting element being a slight superficial congestion, not sufficiently marked to provoke pharyngitis, but great enough to produce an exaggerated action of the sensory nerve-supply. Any continued irritation—smoke, dust, an elongated uvula, etc.—may also act as an exciting cause, while disorders of the digestive apparatus frequently maintain an excessive sensitiveness quite difficult to overcome.

The superficial congestion following infectious disorders readily yields to an astringent, especially if preceded by an application of a 40 per cent. solution of nitrate of silver. The contraction of the blood-vessels induced by the latter is best continued by a spray of resorcin, 8 grains to the ounce, alternating with an alum solution, 10 grains to the ounce, every other day. The applications should be made at least four times daily to keep up the constricting action of the astringents. Cocaine is pernicious in these cases, owing to the weakened state of the local blood-supply. In the other forms of hyperæsthesia enumerated the exciting cause should first be removed, and the same local treatment employed.

Anæsthesia is usually of central origin. It may be met with in connection with other nervous disorders, such as epilepsy and hysteria, and as a sequel of infectious disorders—the paralysis following diphtheria, for instance. It is said to occur in typhus fever and cholera, and to be common in general paralysis of the insane.[1] Treatment of these cases naturally corresponds with that of the central disorder which forms the primary cause.

Motor paralysis also generally finds its cause in a central disorder, the removal of which is essential to obtain a satisfactory result.

On general principles, strychnine hypodermically and general tonics are almost always indicated. Arsenic is especially valuable when the neurosis present is a sequel of diphtheria. Electricity serves the double purpose of assisting in the diagnosis and restoring motion. When the paralysis is of central origin, an interrupted current will cause contraction of the muscles, whereas this contraction will not occur if atrophy of the muscles is the principal pathological element present. In the latter case a cure need hardly be expected. Therapeutically, the method of applying electricity described on p. 444 will serve a useful purpose.

Foreign Bodies in the Pharynx.

The objects most frequently found in the pharynx may be divided into those presenting asperities, such as pins, needles, fish-bones, tacks, bristles, etc., which the contractions of the constrictors in deglutition force into the pharyngeal walls; and those whose dimensions do not allow their passage into the œsophagus—pieces of meat, bread-crusts, coin, etc.

In cases in which a small, sharp object is said to have been swallowed it is well to bear in mind that localized spots of irritation, such as inflamed follicles, frequently give rise to sensations resembling precisely those produced by such a foreign body. These sensations may also be due to scratches produced by the roughness of a piece of dry

[1] Lennox Browne, *The Throat and its Diseases*, London, 1887.

bread-crust, chicken-bone, oyster-shell, etc. accidentally swallowed. To these elements of error may also be added the imaginary foreign bodies of hysterical women.

The laryngeal mirror should first be employed to locate the foreign body, this being greatly assisted by the subjective symptoms and the indications of the patient. A satisfactory examination of the parts is not always possible, however, owing to the marked congestion present. The index finger of the right hand may then be employed, its palmar surface being always directed toward the posterior pharyngeal wall, not only to ascertain the location of the foreign body, but to seize it if its form enables it to insinuate itself between the nail and the finger, provided the former be somewhat long. Pins, needles, tacks, spicules of bone, etc. may easily be removed in this manner. To hold the object solidly the palmar surface of the finger is firmly pressed against the nearest surface as it is withdrawn with the foreign body. When it is too large to be grasped in this manner, the finger should be kept on the foreign body until a suitable curved forceps can be introduced, and, guided by the finger, made to grasp it strongly. A 10 per cent. solution of cocaine applied before these manipulations greatly facilitates them. Inversion of the body is sometimes sufficient to cause the ejection of a foreign body, such as meat, bread, etc.

When, through the presence of a foreign body of exceeding dimensions and located beyond reach, the patient's death appears imminent, tracheotomy should be performed at once, or, if the necessary instruments are not at hand, the trachea can be opened with a penknife, and maintained so with bent hair-pins held in place by means of pieces of tape tied around the neck, until the foreign body can be withdrawn. Foreign bodies in the pharynx very rarely require such extreme measures, however. An object so situated as to endanger life must either close the laryngeal aperture by holding the epiglottis down, being then within easy reach, or so distend the œsophagus low down as to compress the trachea, which it could hardly do sufficiently to absolutely arrest the air-current. In some cases the foreign body may be pushed down to the stomach, and if not angular is usually voided *per rectum* with little or no difficulty. A one-inch screw was thus evacuated by a child three years of age, a patient of the writer.

After the removal of a foreign body there remains for a time a sensation as if it were still there, and it is sometimes difficult to persuade the patient that it has been completely removed.

DISEASES OF THE TONSILS.

TONSILLITIS.

WHEN inflammation of the tonsils, whether superficial or parenchymatous, is recognized early, guaiac seldom fails to arrest it. This drug is fairly entitled to be termed a specific in this affection, and supports through its remarkable action the close association with the rheumatic diathesis which tonsillitis seems to bear. The most effective means of employing it is in the form of the ammoniated tincture, 1 tea-spoonful in a half-glassful of milk, the mixture being employed as a gargle, then swallowed. This should be repeated every two hours at least, until the stools are noticeably increased in number or anal burning becomes marked. Lozenges containing 2 grains of the resin of guaiac may be used with advantage between the doses to keep up the local action. Salol in large doses has recently been recommended by several French writers, its effects frequently showing themselves the same day. Scarification of the inflamed tonsils, allowing the incisions to bleed freely, is another frequently successful means to arrest the attack in its incipiency. After the scarifications the tonsils should be moistened with a 10 per cent. solution of cocaine, which seems greatly to assist in bringing about an early resolution. Any sharp knife may be used for the tonsils, their location bringing them within easy reach. To avoid wounding the surrounding parts, however, it is always advisable to wrap all but about one-fourth of an inch of the point with cotton. Eight or ten stabs directed antero-posteriorly usually produce free depletion and marked relief, and frequently arrest the inflammatory process in its incipiency.

The injection of a few drops of a 10 per cent. solution of cocaine into the inflamed tonsils, by means of a hypodermic syringe armed with a long needle, is also of value in the early stages of the disease to curtail it and to diminish pain when the inflammatory process cannot be arrested.

When the case is seen late and arrest of the disease has become impossible, palliation of the suffering and efforts to bring about an early resolution should be the aim. Remedies requiring muscular effort in the inflamed parts, as deglutition, suction, etc., should be avoided as much as possible. Lozenges, for instance, by requiring frequently repeated swallowing, cause more suffering and local irritation through motion than they do good; steam atomizers produce much the same results through the accumulation of condensed steam induced, and the suction necessary to draw the steam sufficiently far. A thin spray of a solution of cocaine, 4 to 8 per cent., applied with the atomizer at short intervals, and for but a few seconds each time, keeps up the sedative action without involving mechanical irritation of the

parts. The straight tip of the atomizer is introduced between the jaws, which can usually be separated but slightly, and pushed along the surface of the tongue a couple of inches. A few compressions of the rubber ball are then sufficient to moisten the surface of the inflamed tissues. Solutions of other drugs are useless, owing to their limited local action as compared to cocaine.

When gargling is possible much benefit may be derived from water as hot as it can be borne and repeated frequently. It seems to act as an astringent, and greatly to reduce the pain. Warm flax-seed-meal poultices applied externally apparently hasten the course of the trouble, and seem to be productive of relief if renewed frequently.

Hypodermic injections of morphine and atropine, when the suffering is marked, not only reduce it greatly, but, if begun early, tend to shorten the duration of the disease. The latter feature is sometimes surprisingly demonstrated. Aconite internally, in drop doses hourly, when the fever is marked and continued until it disappears, occasionally assists local measures at the outset of the disease. The same may be said of saline purgatives.

When an abscess is formed it is always better to evacuate it than to allow it to open itself, lest it burrow into the surrounding parts and cause complications. The best means to accomplish this is to insinuate the index finger of the left hand into the mouth, and, having applied it over the seat of fluctuation, slip the point of the bistoury alongside and push it into the abscess—at times a very difficult procedure, owing to the impossibility on the part of the patient to open the mouth much more than half an inch. The patient's head should be tilted forward, so as to enable the pus to run out of the mouth, instead of into the larynx or œsophagus. Interesting in this connection is the observation by Rice of New York,[1] that when suppuration occurs in connection with tonsillitis, pus is rarely to be found in the tonsil, but may almost always be discovered in the connective tissue, either in front or behind the tonsil, the abscess being due in nearly every instance to an abnormal relation of the tonsil with the pillars of the pharynx. When no adhesion exists between an inflamed tonsil and the pillars, suppuration is not likely to ensue, while if the adhesion does exist, separation will tend to prevent the abscess. Chiari of Vienna[2] confirms these views, and suggests that in doubtful cases an exploratory puncture be made at the middle of the anterior pillar, the trocar being pushed directly backward.

Hypertrophied Tonsils.

Efforts to remove hypertrophied tonsils by means of astringents, even if the treatment is continued during a prolonged period, can hardly

[1] *Medical Record*, Jan. 31, 1891. [2] *Gazette des Hôpitaux*, May 26, 1891.

be expected to prove successful. Nitrate of silver, advocated by some writers, instead of causing a decrease in their size, rather increases the hypertrophy, owing to the tendency of this drug to encourage the formation of new tissue-elements. Ergotin, alum, tannin, etc. may have shown good results in other hands, but the writer must say that in his these remedies have proved futile. Bicarbonate of sodium, lauded by many, caused superficial irritation after prolonged usage, but failed to accomplished the desired object.

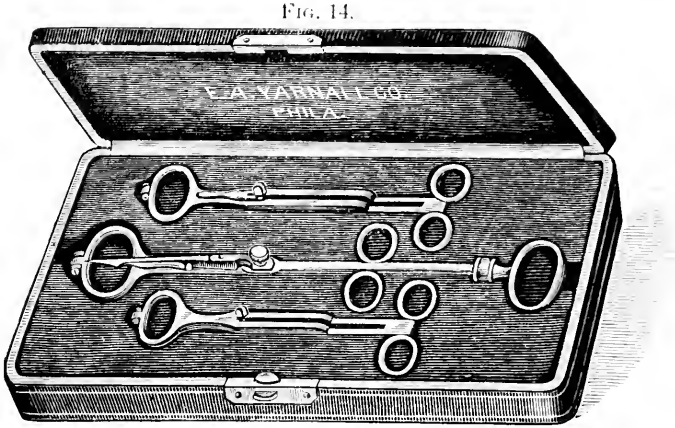
Active surgical treatment for the reduction of hypertrophied tonsils is indicated when they are sufficiently enlarged to occasion complications or to interfere with proper respiration. In adults, however, in whom enlarged tonsils are rare, there is a likelihood of gradual atrophy, which is only worth considering when they occasion no trouble.

Of the means at our disposal for the removal of tonsils other than amputation, the only two worth considering are galvano-cautery scarifications and applications of London paste. The former are practised by introducing the heated galvano-caustic point repeatedly into the tonsil at a sitting, the point being heated to a bright cherry-color. The surface is then seared three or four times. This procedure, repeated every week, produces marked contraction after eight or ten sittings. Many more are required, however, to reduce them completely. London paste, dissolved to the consistence of cream and applied with a piece of stick to the most projecting portions of the tonsil once a week, sometimes causes diminution in size of the hypertrophied tissues, but the method is so painful and tedious as hardly to merit recommendation.

Removal of the tonsils can be performed by means of the bistoury, the tonsillotome, the wire snare, and the electric snare. The operation with the bistoury can be satisfactorily employed in adults, but in children it is sometimes dangerous, owing to the resistance on the part of the patient and the consequent danger of wounding surrounding parts. An ordinary probe-pointed bistoury with a long shaft is the most convenient instrument. After thoroughly anæsthetizing the parts with a 10 per cent. solution of cocaine, the tongue is depressed by an assistant, or by the patient himself if an adult, and a volsella forceps is fastened on the tonsil with the one hand, while the other holds the bistoury. The latter is first introduced *under* the tonsil, and a couple of sweeps are made from below upward until it is cut halfway through. The instrument is then withdrawn, and placed with its cutting edge on the upper portion of the tonsil, and an incision is made from above until the first cut is reached. This frees the tonsil from its base. As generally performed—*i. e.* cutting from above downward—there is always danger of cutting the tongue, especially in nervous patients.

The operation by the tonsillotome presents none of the objectionable features of the bistoury, and can be performed without an assistant. A large number of tonsillotomes are at our disposal, best known among which is the Mathieu instrument, which raises the organ from its bed as it is being removed. The instrument shown in the cut is the writer's modification of Mathieu's tonsillotome, which introduces the feature—

FIG. 14.



one of great advantage—of adjustable rings and blades of different sizes. This makes it possible to encircle an enlarged tonsil of any size before incising it: the operation is therefore rendered much neater, and the traction and tearing accompanying the use of the Mathieu instrument are avoided.

The operation is a simple one. Cocaine anæsthesia having been obtained by local application of a 10 per cent. solution, the tongue is depressed with the left hand, and the instrument is introduced flatwise into the mouth until the ring is on a level with the tonsil. A quarter turn of the instrument on its axis will bring the ring over the tonsil, against which it is then gently pressed. The fingers and thumb-rings being then approximated, the tonsil is perforated and cut off. The pain is very slight, as a rule, and the profuse bleeding that takes place usually stops in a few moments. Very rarely profuse hæmorrhage occurs. In two cases the writer has seen an alarming flow, which recurred seven times in one of them, and was stopped with great difficulty in each instance. This case and the few fatal cases found in the literature of tonsillar operations have caused him to look upon this danger as usually underrated. It is always well to place a drachm or two of tannic acid in the hands of the patient, and to show him how to use it should hæmorrhage recur. He can easily apply it with the end of the finger by slightly moistening the latter, dipping it into the powder, then applying its palmar surface to the bleeding spot.

Amputation with the snare is a rather slow process, fifteen minutes at least being required. The galvano-caustic snare makes it possible to finish the operation much more rapidly, and presents the great advantage of markedly limiting haemorrhage.

Occasionally the enlarged tonsil is found adhering to the sides of the pillars with which it is in contact. It should be detached before the operation by inserting the blunt point of a probe between pillar and tonsil at the points of contact.

The after-treatment is of little importance, the cut surfaces usually healing in a few days without requiring the slightest attention or producing general manifestations. It is always well, however, to advise the patient to use soft food for two or three days, and to avoid highly-seasoned or hot liquids.

Scarification with the galvano-cautery knife is a less heroic, but slower, method of reducing enlarged tonsils. Deep transverse incisions, four or five at a time, into each tonsil, repeated in four days if possible, soon show marked effect. The galvano-cautery point may also be used to penetrate the enlarged organ and cause its contraction; scarification, however, is not only easier to perform, but more effective.

DISEASES OF THE LARYNX.

Subacute Laryngitis.

This form of laryngitis is the most frequently met with. In ordinary life its predominant symptom, hoarseness, is of little importance; in professions in which the voice takes the all-important part—singers, actors, ministers, etc.—however, its successful treatment becomes necessary to livelihood, and should therefore be based on a close study of each individual case. In these cases also the necessity of preserving the integrity of the tissues by avoiding the use of any concentrated agents—nitrate of silver, acids, etc.—that may impair the purity of the voice should be borne in mind.

Among the local causes of the mildest form to be considered is perverted lubrication, especially of the vocal bands proper. Smoke and the prolonged inhalation of dust are prolific causes of this dryness, which determines an inflammatory process of greater or less intensity.

The therapeusis of this condition consists in the use of a warm spray, every two hours, of a saturated solution of potassium chlorate, and 10 grains of ammonium muriate in a tumblerful of water at the same intervals. The last dose should be taken at least three hours before the performance, sermon, etc., to avoid exposure during the stage of perspira-

tion which follows the active administration of the remedy. A lozenge containing 2 grains of ammonium muriate is very valuable in maintaining the effect produced.

Most frequent among the causes of subacute laryngitis are those due to the presence of catarrhal changes of a chronic character in neighboring cavities, especially the nose, naso-pharynx, pharynx, and tonsils. This origin is sufficiently frequent, in fact, to cause a few writers to ascribe every case to some nasal trouble. The intimate anatomical relation between all parts concerned renders it quite certain that whenever a chronic nasal or pharyngeal affection exists, the least exposure to any exciting cause will induce an extension of the inflammatory process to the larynx by continuity of tissue, the predilection of the vocal organ proper in this connection being easily explained by the constant use to which it is subjected. But that this inflammatory process cannot develop without nasal or pharyngeal catarrh as a *prima facies* appears to the writer illogical. The fact, however, that nasal catarrh is present in the majority of the cases we are called upon to treat makes it imperative that we should examine the nasal and pharyngeal cavities in every case, and that with considerable care, for the reason that an almost imperceptible though very active focus of irritation may be found here. Lesions of the anterior nasal cavities are not so apt to cause hoarseness as those of the naso-pharynx or pharynx proper, probably because of the greater remoteness of the parts and the fact that the secretions are apt to be voided anteriorly.

The first question to be considered is that of rest. As a general rule, this is indicated in every case, whether mild or severe; for, as Michel of Cologne states,[1] alluding to vocalists: "Singers who use their voice during a more or less grave disorder almost always cause it to lose some of its brilliant qualities." That this is true there is no doubt, and our recommendation should be framed accordingly, taking the severity of the local trouble as our guide, as regards the duration of the resting period and its degree. In professional singers and speakers, however, rest is rarely possible, and as long as a vestige of voice remains they insist upon a continuance of their work. What are we to do in these cases? Without doubt the most advantageous plan to all concerned is frankly to disclose to the patient the dangers incurred; to recommend abandonment of rehearsals, limitation to the smallest degree possible of the part to be sung or spoken; to transpose, when possible, all high notes, or, if this is not possible, to shorten the chest register a couple of tones, thus changing to the head tones without having to throw upon the larynx the strain of the two highest notes of the chest register; in other words, to limit as much as practicable the work of the vocal apparatus.

[1] *Revue de Laryngologie, d'Otologie, etc.*, March 15, 1889.

A general point of importance in the treatment of these cases is one frequently overlooked—attention to intestinal action. In female singers especially constipation is almost the rule, due, probably, to the irregular attention they can give themselves, their varying diet, and the continued travelling in railroad cars, the last being a very active agent.

Purgatives are very useful, but in singers and public speakers even mild aperients are, for obvious reasons, out of the question. Enemata, while being immediately effective, present the advantage of not diminishing the patient's strength. An enema composed of 1 pint of lukewarm water and a table-spoonful of glycerin will sometimes be found to act surprisingly, not only on the intestines, but on the voice, especially if, as is often the case with travelling artists, the bowels have not been moved for several days. Important also in this connection is the influence of the gastric and hepatic organs in maintaining the catarrhal affection which induces the hoarseness, and to which singers who indulge themselves rather freely are specially liable. An emetic, followed every two hours until the performance by 10-grain doses of bismuth, acts most promptly in these cases.

Taking now the treatment of the catarrhal disorders of the nasopharynx in the order in which they were described, we will first consider coryza involving the nose proper and the vault. The turgescence of the erectile tissues of the anterior cavity should first be reduced by a local application with a pledget of cotton of a 4 per cent. solution of cocaine. This accomplished, a powder composed of $\frac{1}{8}$ grain of morphine acetate, 1 grain of bismuth subnitrate, and 1 grain of sodium salicylate is blown into each nostril, taking care to project the powder sufficiently far to include the pharyngeal vault. The walls of the cavities being thus well covered with the sedative powder, a fine spray of liquid cosmoline is thrown over the whole. The procedure should be repeated in four hours if possible. If fever is present, drop doses hourly of tincture of aconite will usually reduce it markedly and favorably influence the catarrhal process.

If the nasal trouble be but an exacerbation of a chronic rhinitis, masses of secretion are often the principal cause of irritation. Their removal by means of a coarse spray of a solution of 5 grains of bicarbonate of sodium to the ounce of water assists the other portion of the treatment. When an attack of coryza is of several days' duration more active means are necessary to bring about an immediate and lasting cessation of at least the occlusion of the nose. An incision with a small galvano-cautery knife into the most prominent swellings over the turbinated bodies of one side is of service. The most satisfactory local application to the pharynx in an exacerbation of simple or follicular pharyngitis is a solution of nitrate of silver, 40 grains to the ounce. A

solution of this strength acts to a degree as an anæsthetic by causing contraction of the capillaries. It should be applied with a cotton pledget, after thorough cleansing of the surface with a spray of the bicarbonate-of-sodium solution mentioned. Care should be taken to allow none of the solution to fall into the laryngeal cavity. Inflamed follicles, if painful, should be cauterized lightly with a galvano-cautery point, not more than three or four, however, being destroyed at one sitting. The counter-irritation produced by cauterization frequently clears the voice markedly, especially for the evening of the day on which it is performed. As far as the treatment of the larynx proper is concerned, the writer cannot say that in his hands the ordinary carbolized sprays, Dobell's solution, etc., have given the results claimed by many; in a number of cases, in fact, they seemed to act more as irritants than sedatives. When there is considerable adhesive secretion in the larynx, however, they become useful as cleansing agents. Much more effective in reducing the hyperæmia, and therefore the turgid condition of the capillaries of the vocal bands, is a solution of resorcin, 7 grains to the ounce. A stronger solution causes too much dryness; a much weaker one is ineffectual. The preparation should be used with an atomizer about every two hours the first day, then three times daily. To enable the solution to bathe the bands thoroughly the voice should be sounded *during inhalation*, while the fluid is being sprayed in, the bands being thus brought in and forming a floor, as it were, at the lowest portion of the larynx. When the hoarseness is great an application with the cotton pledget of carbolized iodo-tannin or a solution of perchloride of iron, 20 grains to the ounce, causes a sudden contraction of the capillaries, which is effectively maintained by the resorcin solution.

When the case is a recent one and is seen early in the day, an insufflation of the powder recommended for the nose (morphine acetate $\frac{1}{8}$ grain, bismuth subnitrate 1 grain, and salicylate of sodium 1 grain), repeated in two or three hours, will sometimes succeed in aborting it, especially if the powder is well distributed over the laryngeal surfaces, and if a fine spray of liquid cosmoline is thrown over the powder. A thin coating is thus formed over the inflamed membrane, which protects it for some time against the irritating action of the air-current. Morphine has a "benumbing" action on the vocal bands, and should not be used within four hours before singing or preaching.

Of great assistance in this class of cases, as well as in the muscular variety, next to be considered, is the use of "vin Mariani" when taken not only a half hour before the performance, but at the end of each act, so as to get the benefit of "toning" action when the next act is about to begin.

Hoarseness of myopathic origin is most frequently recognized in

women, possibly because their larynges do not as frequently as in men present the permanent hyperæmia of the bands which renders a positive diagnosis almost impossible. The larynx shows but little, if any, alteration from the normal. This, of course, does not apply to paralytic or even true paretic cases, in which characteristic appearances would be present, but to atony of the muscles. The speaking voice is normal. The singing voice is generally alone affected, and that only in certain tones, though weakness pervades them all. The higher tones are generally "lost in the breath;" that is to say, the passage of the air through the glottis is much more audible than the note proper, although in a small proportion of the cases the upper portion of the chest register may alone be affected.

The treatment of this condition differs in every particular except one from that of the preceding condition. The exception is the attention to be paid to the gastro-intestinal system, which may be found to be an important element in a small proportion of cases. In emergency cases the voice is sometimes markedly improved by a mild faradic current, the positive pole being applied behind the larynx, below the inter-arytenoid notch, and the negative externally on each side of the thyroid cartilage. The point of the laryngeal electrode should be flattened from before backward and covered with chamois skin. For an external electrode the writer usually uses the thumb and index finger of his left hand, the end of the battery cord being fastened to the palm. In this manner he can make the application with much more exactness over the location of the muscles he desires to influence on each side of the glottis, penetration being secured by frequently dipping his fingers in water. The crico-thyroid and crico-arytenoid are first treated by placing the fingers on each side of the space felt below the thyroid cartilage, and sliding them antero-posteriorly along the groove felt in the deep tissues, the skin which slides over the latter with the fingers being pinched when they are approximated anteriorly. To treat the thyro-arytenoid the fingers are merely moved a quarter of an inch higher (just below the lower border of the thyroid), and the same procedure gone through with. The length of the application depends entirely on the ability of the patient to stand the electrode in the larynx. It is generally well tolerated, owing to the fact that it does not enter the laryngeal cavity. Five minutes represent the usual time occupied in such cases. The electrode is introduced a few seconds, then withdrawn, then reintroduced, and so on, great care being taken to avoid touching the base of the tongue. A solution of hydrochlorate of cocaine can be used to anæsthetize the spot upon which the electrode is to be placed, but the pernicious after-effect of this drug on the voice when the latter is to be used within a few hours renders the drug undesirable.

Internally, a pill composed of quinine sulphate 1 grain and extract of nux vomica $\frac{1}{4}$ grain, administered every two hours, maintains the muscular tonicity throughout the performance, especially when Mariani coca wine is taken between the acts, as previously recommended. The curative treatment includes the electrical application three times a week, and iodide of potassium 5 grains, gradually increased to 30, three times daily if the patient can bear it, which he will be much more likely to do if it is administered in a glassful of water immediately after meals, and if 3 drops of Fowler's solution are given with each dose.

In cases characterized by severe congestion the patient should remain at home and avoid as much as possible atmospheric transitions, such as going from one room to another of a different temperature, sitting by an open window, etc. He should also avoid smoking or the inhalation of air contaminated with smoke, and alcoholic beverages.

A sharp attack of subacute laryngitis can frequently be cut short by a derivative purgative, castor oil, calomel, and colocynth being effective in the order named. Although a popular remedy, castor oil still holds its own as a derivative for laryngeal affections, and is far from meriting the obsolete position it is occasionally given. One-drop doses of the tincture of aconite-root every hour should be administered at the same time, the pulse being closely watched to prevent undue action.

A less unpleasant method of arresting an attack in the early stages is to apply a 10-grain solution of cocaine to the larynx every half hour,[1] either with the atomizer or by means of a laryngeal brush, Mariani wine of coca, a sherry-glassful every two hours, being given internally. This method is especially valuable when the patient is unable to remain at home, the anæsthesia of the larynx produced by the coca preparations greatly limiting its sensitiveness to external influences. If an idiosyncrasy against cocaine exists, a solution of resorcin (10 grains to the ounce) may be substituted as a local remedy.

Benzoin is sometimes very efficient in these cases. A tea-spoonful

[1] The writer has not as yet encountered a case in which hydrochlorate of cocaine, when employed as indicated, was followed with deleterious effects. The fact that alkaloids in the form of crystals are usually purer than the same alkaloids that are granular in shape *may* on general principles furnish a reason for this, the crystalline alkaloid alone being employed by the writer. He employs a preliminary test to ascertain whether there is an idiosyncrasy in the patient—applying a small quantity of the solution with a cotton pledget and waiting a few minutes—but has not as yet encountered a subject in which the susceptibility to the drug was present. A prominent physician under the writer's care, who, on his own responsibility and against the latter's wish, used a quantity of solution representing at least 10 grains of the alkaloid within an hour, was the only case ever observed in which temporary discomfort ensued.

of the tincture being placed in a tea-cupful of boiling water, the cup is covered with a towel folded in the shape of cone, a hole being left at the apex. The nose and mouth being inserted into this hole, the medicated steam is inhaled as long as it is evolved.

Acute Laryngitis.

This form of laryngitis being characterized by intense inflammation involving the submucous tissue, energetic and prompt measures are of prime necessity. The first step is to ascertain the degree of infiltration by means of the laryngoscope. The respiration should not be taken as a criterion, as the œdema in the upper part of the larynx may be quite severe at first, without presenting much obstruction to the passage of air, and suddenly kill the patient by closing the laryngeal aperture unexpectedly. If the infiltration is limited, a general derivative treatment may be of service. A hot mustard foot-bath, followed by free diaphoresis, avoiding at the same time all drinks, may prove very beneficial by drawing blood to the periphery and diminishing local pressure. Tincture of belladonna, 5 drops every hour until its physiological effects become marked, also tends to counteract the infiltration by contracting the laryngeal blood-vessels.

Local applications in the form of powders, or solutions requiring the use of the brush or the cotton pledget, are inadvisable, the mechanical irritation doing more harm than the agent applied does good. A fine spray is the least irritating medium, and a 10 per cent. solution of cocaine the most effective agent if the cocaine employed is of a good quality. The depletion occasioned by the contraction of the blood-vessels must, however, be maintained, and the atomizer should consequently be used about every twenty minutes until the acute symptoms have disappeared. The writer generally employs a mixture composed of one-half of a 20 per cent. solution of cocaine and one-half listerine. The antiseptic action of the latter adds greatly to the detergent effect of the mixture, and renders it less liable to undergo alteration. In cases in which infiltration is not present, and the intense congestion causes this complication to be merely feared, a spray of resorcin, 10 grains to the ounce, is often sufficient to reduce the inflammatory symptoms.

When œdema is unmistakably present, surgical measures become necessary. The swelling must be scarified and relieved of at least a portion of its contents—a procedure rendered easy by the use of the laryngeal mirror. The ordinary pocket-case bistoury may serve the purpose efficiently, its blade being surrounded by cotton wadding to within a quarter of an inch of the point, to prevent cutting of the parts anterior to the larynx. The tongue being drawn out, the epiglottis will generally be seen standing erect and swollen. The mirror being

introduced, the knife is passed around the side of the epiglottis, and its point is pressed into the external border of the ary-epiglottic fold, thus causing the blood and serum to flow into the pyriform sinus instead of the laryngeal cavity. The other side of the larynx should be treated in the same manner if possible. There are many special lancets for the purpose, but as they are seldom at hand just at the time needed, dependence had better not be placed on them. The relief is usually immediate, and a repetition of the procedure is seldom necessary.

In some cases the symptoms are so urgent as to preclude even scarification from the safe resources. Unless a set of intubation instruments be at hand, and intubation can be resorted to without hesitation, rapid tracheotomy must be performed to save the case.

Convalescence from an attack of acute laryngitis is usually quite slow, the voice remaining husky for some time, while recurrence of the acute symptoms under exposure is by no means a remote possibility. This of course suggests great care for at least a month after the attack, not only as far as atmospheric surroundings are concerned, but also as regards diet, which should be of an unirritating character. Astringent sprays—alum, sulphate of zinc, or resorcin, 5 grains to the ounce—tend to encourage resolution.

Suarez de Mendoza[1] recently recalled the fact that pilocarpine, injected hypodermically, proves very efficacious in reducing laryngeal œdema. Six drops of a 5 per cent. solution of the alkaloid, repeated three times at intervals of fifteen minutes, caused complete relief in the cases reported.

Secondary Œdema of the Larynx.

Œdema occurring as a secondary manifestation of a general disease is of course more prone to recurrence than the inflammatory form just described. A primary affection, whether renal, cardiac, or hepatic, forming the cause of obstruction, the laryngeal œdema fluctuates with its clinical variations. This form of œdema presents itself without inflammatory manifestations, and local applications, derivatives, and even depletory measures, with the exception of saline purgatives, which may not be indicated in the treatment of the original affection, are of doubtful value. The only resource is scarification, in the manner described under the last heading. The incisions should be free, and as much serum as possible evacuated. If the scarifications do not relieve the dyspnœa, subglottic œdema is in all probability present, and tracheotomy is the only resource.

It might be well to mention in this connection that the administration of iodide of potassium is a dangerous measure when œdema of the larynx forms a complication of any disorder.

[1] *Revue de Laryngol.*, Aug. 15, 1891.

Perichondritis and Chondritis of the Larynx.

All the diathetic processes characterized by ulceration of the laryngeal mucous membrane and many of the acquired affections involving the larynx may give rise to inflammation of its cartilages and their covering, the perichondrium. Thus, syphilis, tuberculosis, cancer, erysipelas, gout, measles, typhoid-fever, typhus, variola, blennorrhagia, etc. may be the cause. The fact that its initial symptoms, objective and subjective, are very insidious, make an early diagnosis rarely possible. When pain, usually the first symptom, is present, accompanied with localized redness and swelling, a strong solution of cocaine, applied with a cotton pledget, does much to reduce it and to assist any tendency to resolution. When an abscess becomes evident, an aspirator may be used to empty it of its contents, a long, thin, curved trocar, passed through a universal mirror-handle, serving the purpose after thoroughly anæsthetizing the larynx with cocaine. This procedure avoids the necessity for the preliminary tracheotomy which is always indicated when an incision is required to withdraw necrosed cartilage or thick pus. The trachea in these cases must be opened low down, to avoid any proximity to the inflammatory process. The general treatment is of course that of the primary affection.

Chronic Laryngitis.

The association so frequently noticed between chronic inflammation of the naso-pharynx and of the larynx renders it imperative always to examine the entire upper respiratory tract when continued hoarseness is complained of. This is further supported by the fact that cases are often met with in which no benefit whatever is derived from treatment limited to the larynx until attention is given to the naso-pharyngeal surfaces. Cleanliness of these parts, in fact, may be considered a *sine quâ non* of success in 90 per cent. of cases. The characteristic congestion of this affection, and even the superficial erosions frequently encountered, will in the majority of cases yield to a detergent spray of bicarbonate of sodium, borate of sodium, and salicylate of sodium, 3 grains of each to the ounce of water, applied copiously three times a day to the entire upper respiratory tract—the nose, the pharynx, and the larynx. This, of course, applies to cases in which any nasal or pharyngeal affection that may have existed has been thoroughly treated.

Local treatment after cleansing is also most efficient when carried out by means of the atomizer, the cotton pledget being only used to touch the erosions with stronger agents. Resorcin is an effective agent in a solution containing 7 grains to the ounce. A 20-grain solution of

iodoform in benzoinol is a very effective remedy, but the difficulty of keeping the atomizer free when benzoinol is used renders its employment obnoxious to the patient, to say nothing of the unpleasant odor of the iodoform. Iodol might be substituted, but it possesses irritating properties when used in strong solutions: 5 grains to the ounce is the maximum strength that an inflamed larynx can stand with benefit. Solutions of sulphate of zinc, sulphate of copper, and alum, 5 grains to the ounce, may be substituted should the other agents recommended not be obtainable.

The dark-red or bluish patches and erosions occasionally observed need special treatment—one, it must be said, in which the practitioner's dexterity will be taxed quite severely. Each spot must be touched with a 60-grain solution of nitrate of silver, a small cotton pledget securely held in a laryngeal forceps being used. Care must be taken that the cotton be not too greatly loaded with the fluid, lest compression in the larynx cause the solution to drip into the trachea. Before cocaine was introduced spasm of the larynx was to be feared in such applications. A preliminary application of a 20-grain solution of cocaine will, however, prevent this complication if at least four minutes elapse between the application of the anæsthetic and the astringent. The applications should be repeated every other day. Chloride of zinc, 10 grains to the ounce, may be used in the same manner if fear of using nitrate of silver be entertained; but the case will drag on much longer.

In certain cases the vocal bands will present, during an exacerbation of the catarrhal process, the greatest amount of congestion as compared with other parts of the laryngeal cavity. Their mucous membrane appears thickened, bosselated, and very red at the edge, the voice being coarse and screechy when an effort to sing is made. This form of chronic laryngitis is characterized by frequent exacerbations, and finally costs a singer his voice unless he stops singing for a while and undergoes active local treatment. Labus of Milan[1] proposed flaying of the vocal bands in these cases, and obtained several satisfactory results. After thoroughly anæsthetizing the larynx he tore off with a sharp square-tipped laryngeal forceps the superficial layer of membrane of the vocal bands—a procedure followed by slight hæmorrhage, a few days' aphonia, and final recovery of the voice. The writer[2] substituted applications of chromic acid to destroy the thickened mucous layer, obtaining equally satisfactory results. Cocaine causing a copious flow of lubricating fluid from the lateral tissues when applied to the larynx[3] for a certain length of time, it is necessary to use the acid as soon as possible after

[1] *Archives of Laryngology*, volume of 1880.

[2] *Transactions American Laryngological Association*, session of 1888.

[3] See writer's observations, *Ibid.*, p. 124.

the application of the 25 per cent. solution, the strength it is advisable to employ. The chromic acid, fused by heat to the end of a covered probe, such as MacCoy's, immediately before the anæsthetic, is then applied to the surface of one of the vocal bands, while the patient, having been told to make a sound, brings both bands into apposition. This enables the operator to avoid cauterization of their edges—an important point in the preservation of the voice, especially in women. But little if any disturbance follows, and after a few days hardly a trace remains of the cauterization, except a spot presenting less redness than the surrounding parts. The applications should be made twice a week until all traces of localized congestion or bosselated areas have disappeared.

Chronic laryngitis is sometimes aggravated by gastric, hepatic, or intestinal disorder, especially in drinkers and smokers. Attention to these conditions should of course form an important part of the treatment in such cases. In excessive smokers the congestion is often maintained simply by the irritating action of the air contaminated with smoke. Sitting in a smoking-car or in a room in which others are smoking is therefore as bad as if the patient himself were smoking.

Dry Laryngitis.

This affection, generally termed laryngitis sicca, corresponds with the affection previously described under the name of dry pharyngitis, and occurs in the great majority of cases as a result of the latter affection. The lubricating fluids of the larynx being greatly reduced, mucopurulent masses are formed which adhere to the membrane and add greatly to the inflammatory process.

Attention to the naso-pharyngeal disorder forms an important part of the treatment. Detergent and disinfecting sprays are of great use, but must be employed for a considerable time. Chlorate of potassium in the form of a saturated solution, and permanganate of potassium, 3 grains to the ounce, are the most effective agents, while listerine and water, equal parts, may also be recommended, to alternate with either. Iodide of potassium, administered internally, 5 grains three times a day in half a glassful of water, tends to increase the laryngeal secretions, as it does those of the nasal cavities, especially in persons who are sensitive to its physiological effects.

Tuberculous Laryngitis.

Although the treatment of this affection is seldom followed by complete recovery, the proportion of cases resulting favorably is gradually increasing. Bosworth[1] recommended some years ago a course of treatment which at least did much to demonstrate the importance of a

[1] *Diseases of the Throat and Nose*, New York, 1881.

systematic line of procedure in not only retarding the progress of the local trouble, but in some cases causing its disappearance. Absolute local cleanliness, maintained by means of detergent sprays, is the first indication. A solution of borax in rose-water, 5 grains to the ounce, is used by the writer for this purpose, a coarse atomizer, such as Sass's, being employed. The larynx being thoroughly cleansed, an anodyne is next in order. Cocaine in this condition is certainly of the greatest value, and, gently applied with a cotton pledget held in a laryngeal forceps, it arrests the suffering almost at once, and enables the patient to enjoy at least a couple of hours' respite, which he can take advantage of to take food. The effect can be maintained by a spray of a 4 per cent. solution, used by the patient himself. Lozenges might be used advantageously were the swallowing accompanying their use not pernicious as a mechanical irritant. Insufflations of morphine might also prove advantageous did not the secondary dryness of the throat characterizing the use of this drug preclude its continued use. In some cases, however, these pernicious effects do not obtain, and much assistance may be derived from the use of both cocaine lozenges and morphine powders, the latter being best applied finely triturated and in doses varying from $\frac{1}{8}$ to $\frac{1}{4}$ grain with an insufflator.

In the same manner iodoform may be used, for it is valuable in all ulcerations of mucous membranes, and often efficacious in the larynx when the ulcerations are shallow. The quantity applied should be sufficient to cover the entire laryngeal surfaces with a thin film, and be renewed daily at least, twice a day being preferable. A less disagreeable way to apply the remedy is that suggested by the late Dr. Elsberg of New York—*i. e.* dissolving the drug in ether to saturation. This solution may conveniently be used with the atomizer by the patient, and can therefore be applied frequently. The ether produces a temporary local anæsthesia, which is very grateful to the patient, and the unpleasant odor of the iodoform is masked by it to a great degree.

When superficial erosions and ulcerations do not yield to these measures they seldom show any tendency to submit to the influence of astringents—nitrate of silver, in solution of various strengths; tannin, 10 grains to the ounce; or sulphate of zinc, 10 grains to the ounce, which are next in order.

A valuable remedy is that proposed by Krause[1]—namely, lactic acid. To obtain the best results with this agent the larynx should be thoroughly anæsthetized with a 25 per cent. solution of cocaine. Two or three of the spots of ulceration are then selected for the acid application, and a small sharp curette is employed to scrape them, all hæmorrhage being prevented by the cocaine. It is perhaps needless to state that the laryngeal mirror must invariably be used. This done,

[1] *Revue mensuelle de Laryngologie*, Nov., 1886.

the scraped ulcers are as much as possible dried with absorbent cotton, and a 20 per cent. solution of lactic acid having been prepared, it is applied by means of a small pledget of cotton held in a laryngeal forceps to each of the two or three spots of ulceration selected. The cotton pledget moistened with the acid solution should be kept in contact with the ulcer two seconds if possible. In some cases considerable irritation ensues; in others almost none is noticed. The applications should be repeated every day, the strength of the solution being gradually increased by 10 per cent. at intervals of two or three days, according to the degree of irritation excited. Rosenberg's method of injecting a 20 per cent. solution of menthol in olive oil finds many supporters. Thirty minims can be dropped over the laryngeal surfaces without, it is said, producing discomfort.[1]

Tracheotomy is advocated by writers of the eminence of Beverly Robinson and Moritz Schmidt, with a view to give the diseased larynx perfect rest, to deviate from it the passage of irritating air, and to better respiration. Schmidt[2] reported good results in eight cases, and arrived at the following conclusions: 1. If there is stenosis, the operation should not be delayed. 2. It is indicated where the laryngeal disease is marked, but where the lungs are comparatively healthy. 3. Also in rapidly-advancing laryngeal disease before dyspnœa supervenes. 4. And, above all, if dysphagia is present.

Of importance is the attention to diet, which should be nutritious though unirritating. Cream is swallowed with more ease than milk, owing to its greater specific gravity, and pap-like dishes than soups, for the same reason. Rare meat finely hashed is readily swallowed, especially if mixed with an egg. Oysters are also taken without trouble, provided they are not too salt. Raw eggs can generally be swallowed with ease. In a word, extremes must be avoided; the food must not be hard nor absolutely liquid; it must not be too highly seasoned, nor should it be too bland, else there will be a distaste for food. Leaning over anteriorly while eating causes the food to pass down along the pyriform sinuses, thus avoiding the upper portion of the larynx, contact with which causes the severe pain experienced by advanced cases during the act of deglutition. This suggestion was obtained from that of Norris Wolfenden of London, who advises that the patient lie face downward on a lounge, with his head hanging over the lower end, and thus draw into his mouth by means of a rubber tube any liquid from a tumbler placed on the floor.

The favorable location of the larynx as regards elimination of detached products, etc. renders it exceedingly suitable for treatment with

[1] Cozzolino, *Rivista de los Hospitales*, No. 29, 1891; J. Walker Downie. *Brit. Med. Journ.*, Apr., 1891.

[2] *The Throat and its Diseases*. Lennox Browne, London, 1890, p. 394.

Koch's tuberculin. Indeed, this remedy, though by no means entitled to be classed as a specific, is nevertheless worthy of being considered, in the light of our present knowledge, the most potent agent yet produced. In the lungs the elimination of necrobic eschars is one of the great drawbacks of the method, the remedy becoming in this sense a source of serious danger. In the larynx, where the evolution of the curative process may be observed with freedom, the more or less intense localized redness following the injection of the remedy, the occasional circumscribed œdema rarely requires active intervention. Local transformation of active lesions into foreign bodies, which when ejected leave in their place an ulcerated, red, and granular surface, which heals sooner or later, etc., follow the injections of tuberculin without interference and without involving the *sui-generis* secondary manifestations that the same process in the lungs is more than likely to produce, especially when extensive lesions are present. This is so true that in some cases of laryngeal and pulmonary phthisis the laryngeal lesions completely disappeared and were considered as cured, while little or no benefit could be observed in the lungs.

In cases of primary laryngeal phthisis, complicated with few or no pulmonary manifestations, a number of cures have been reported in the enormous literature of the subject. What "cure" means with so dangerous a remedy remains to be seen. The possibility of acute universal phthisis, as expressed by Virchow, can doubtless be read between the lines of many of the cases reported, while those reported as favorably influenced have not as yet had time to show their *final* termination. The opinion is rapidly gaining ground that want of success may be ascribed in a large number of the cases reported to excessive and too rapidly increased injections made, the tendency having been to seek reaction instead of therapeusis. This is doubtless a wholesome trend of opinion, and one that may lead to the recognition of the limit of toxicity possessed by the remedy. Moritz Schmidt at the Congress of Internal Medicine of Wiesbaden[1] stated that he regulated the treatment according to the cause of the affection. He injects $\frac{1}{2}$ milligramme as a first dose, 1 milligramme during the first month, 2 milligrammes the second month, etc., the injections being made every four or eight days according to the local and general reaction. This course offers less risk, without in any way decreasing the chances of success, and is to be recommended in every way. It goes without saying that the vital forces of the patient should be carefully supported by appropriate diet.

Syphilitic Laryngitis.

The proclivity of the upper respiratory tract to become the seat of

[1] *Revue internat. d. Laryngologie*, July and Aug., 1891.

secondary and tertiary manifestations of syphilis probably depends in a great measure upon the frequent presence in this locality of catarrhal disorders which weaken its resisting powers. This should be borne in mind in the treatment, and detergent washes ordered, not only for the laryngeal surfaces, but for the nasal and pharyngeal cavities, when any indication of a catarrhal congestion is detected. In secondary lesions these are usually quite sufficient as local measures, and the tendency to spontaneous resolution which characterizes such lesions is greatly enhanced. If the mucous patches seem stubborn, a 60-grain solution of nitrate of silver, applied with a very small cotton pledget to each spot after partially anæsthetizing the larynx with a 10 per cent. solution of cocaine, will soon cause them to disappear. As a cleansing agent a solution of bicarbonate of sodium, borate of sodium, and salicylic acid, 3 grains of each to the ounce of water, may be used with advantage.

In secondary manifestations, when the diagnosis is rendered positive by the mucous patches and other evidences, a mercurial treatment is indicated to prevent, if possible, the appearance of tertiary syphilis. The red iodide of mercury has withstood the test of time, and is still, in the writer's opinion, the most satisfactory preparation to fulfil this purpose. As recently tabulated by Mahé,[1] "1. It is a stable compound, permitting absolute accuracy in dosage. 2. It is as powerful a tonic as any mercurial preparation. 3. It is nearly twice as effective as a germicide. 4. The quantity of mercury exhibited can be reduced to a minimum, the dose being small. 5. It is not decomposed by, nor does it interfere with the simultaneous administration of, iodide of potassium when such a combination is necessary. 6. There is no danger of poisoning a patient by the possible change into other substances." The preparation should be administered in doses of $\frac{1}{16}$ grain three times daily, and alternated, if ptyalism occurs, with iodide of potassium, 10 grains night and morning. After six weeks' or two months' steady treatment a rest of two or three weeks should be given, and Rabuteau's pills of carbonate of iron administered, one after each meal, if any indication of anæmia be present. The mercurial should then be renewed, withdrawn, and again renewed, according to the indications of the case, which should remain under treatment at least one year.

When the tertiary manifestations are present, the system must, as soon as possible, be brought under the influence of antisyphilitic treatment, to check in the briefest time possible the ulcerative process. Mercurial inunctions, a piece of mercurial ointment the size of a cherry rubbed into a different part of the body three times daily, show their influence in a few days, when they may be reduced to two a day.

[1] *Annual of the Universal Med. Sciences*, sect. M, p. 25, series 1890.

When the gums show evidences of beginning ptyalism the mercury had better be replaced by iodide of potassium, beginning with 10 grains three times daily, and increasing at the rate of 1 grain per day, until 30 grains are administered three times a day. While iodide of potassium is being used the urine must be closely watched, and if it becomes scanty or its specific gravity becomes abnormally increased, prudence must be exercised lest œdema of the glottis occur. The larynx should be frequently examined, and if any indication whatever of œdema appears the drug must be decreased or temporarily withheld, as the case may be. Œdema rarely occurs, however, and when the maximum dose has been reached, it can generally be continued for a long time, and then gradually decreased as it was increased. To prevent gastric disturbances, the iodide should be administered in a tumblerful of pure water after meals. Should its physiological effects become manifest, the administration of Fowler's solution, 3 drops, with each dose, gradually increased, will effectually overcome them and act as a tonic.

The local treatment is of importance, not only to assist the healing process, but to diminish suffering. The detergent spray already mentioned can be used advantageously to detach the layers of pus which cover not only the ulcerations, but the adjoining parts. When they have been thoroughly cleansed, a 10 per cent. spray of cocaine should be employed to anæsthetize the parts prior to the application, by means of a small cotton pledget held in the laryngeal forceps, of a solution of nitrate of silver, 120 grains to the ounce. This preparation is preferable to the pure crystal, which tends to encourage cicatricial contraction of the parts touched. Only the ulcerations should be touched with solution, the laryngoscope being of course necessary to render the manipulation accurate. Insufflations of iodoform may be substituted by those who find the preferable method too difficult.

When extensive ulcerations are present, cicatrization and secondary contraction are hardly avoidable, the adhesions formed being occasionally of such a nature as to render tracheotomy and the permanent wearing of a tube necessary. Frequent dilatation with a curved probe during the stage of formation will do much to limit the contraction, while the laryngeal bistoury may be used with advantage to sever any web that may be reached. The patient should be occasionally examined after recovery, the process of cicatrization sometimes requiring years to attain the maximum of its development.

In cases of cicatricial stenosis cutting dilators—Stoerk's, Whistler's, or Lennox Browne's—become necessary. The first two instruments require preliminary tracheotomy, their olive-shaped tips occluding forcibly the aperture left by the cicatricial bands. Browne's instrument, however, does not require preliminary tracheotomy, its tube-shaped shaft

serving as a passage for air. The larynx should be anæsthetized with a 20 per cent. solution of cocaine, thereby enabling the operator to use more force in passing the olive tip of the instrument through the laryngeal aperture before and after the incision made by the hidden knife which it contains. This operation, it must be said, is not always satisfactory; neither is that of intubation with a stationary tube.

Erysipelas of the Larynx.

Although erysipelas of the larynx usually occurs as a complication or continuation of the same process in neighboring parts, it may be primary in a small proportion of cases. In either case the presence of erysipelas in this locality is accompanied with much danger to life, not only through the local complications, such as œdema, which may come on without warning, but on account of general disorders caused by the disease—pneumonia, pulmonary œdema, heart failure, general toxæmia, and cerebral adynamia. For this reason internal medication calculated to offset the tendency to grave complications should at once be begun. Alkalines, such as chlorate of potassium, bromide of potassium, etc., are best avoided, owing to their pernicious influence on the renal functions, and digitalis should be administered in sufficiently large doses to support cardiac action and produce gentle diuresis. The tendency to œdema of both larynx and lungs is greatly diminished by the diuretic action of the digitalis, the heart's action is kept vigorous, and the likelihood of albuminuria—an evil omen in these cases—is greatly diminished. Of great value in the prevention of toxæmia is iodoform, also administered internally, 1 or 2 grains in pill form being given every two hours. It reduced the pulse and seemed to decrease suffering in the cases in which it was used by the writer. The patient's strength should be supported by tincture of the chloride of iron, 15 drops three times a day, mixed with glycerin and water.

Locally, the most effective agent is without a doubt cocaine. A strong solution, 25 per cent., should be applied, however, to obtain satisfactory results. When laryngeal œdema is present the cocaine solution is often sufficient to reduce it and to keep it down. Occasionally it is necessary to scarify freely. Tracheotomy is of doubtful value in this disease, while intubation is difficult to perform, owing to the swelling of the epiglottis and surrounding tissues.[1] It nevertheless has rendered valuable service in this country.[2] Bedford Brown observed that the free application of sinapisms was followed by immediate reduction of laryngeal stenosis.

Food must be soft or liquid and concentrated, in order to obtain as

[1] F. de Haviland Hall, *Journal of Laryngology*, Aug., 1891.

[2] Delavan, *Annual of Universal Med. Sciences*, section E, p. 2, series 1891.

much nutrition as possible from the quantity ingested. F. de Haviland Hall recommends rectal feeding. Stimulants are indicated when the weakness is marked or when profuse diaphoresis is present.

Neuroses of the Larynx.

Motor Paralysis.—The many factors entering into the etiology of motor paralysis must be closely studied before any attempt is made at treatment. The etiological factor once ascertained, little is to be expected unless treatment bearing upon it can be employed. The likelihood of cure corresponds with the degree of amenability to treatment of the original cause. Whether it be syphilis, tuberculosis, aneurism, a cerebral neoplasm, etc., local treatment is absolutely subservient to that of the primary affection, and the treatment of the latter, which does not require elaboration here, is therefore the first indication.

This done, measures must be adopted to stimulate the laryngeal muscles to action. For this purpose faradization employed in the manner indicated on p. 443 is most effective for general distribution of the current through the entire larynx. The laryngeal electrode (Morell Mackenzie's), as shown in the engraving just alluded to, is more effective without water, however, when localized faradization is necessary. The mode of using it is as follows: The electrode being connected with the negative pole of a faradic battery, its extremity is introduced into the larynx, while the positive pole is connected with an ordinary surface electrode which the patient presses over the larynx externally, or with a necklet-electrode. The extremities of both electrodes should be covered with sponge or kid, to prevent stinging. To ensure penetration of the current the electrode tip should be thoroughly wetted before each application. The manipulation of Mackenzie's electrode is like that of an ordinary laryngeal forceps, the mirror being employed to note and conduct the localization of the tip of the instrument. The nearer the paralyzed muscle the application, the better. The electrode being in position, the finger-rest on the top of the handle is depressed, and firm pressure is exerted on the neck by the other electrode. At first this manipulation is quite difficult to perform, gagging and retching preventing the introduction of the instrument. After a few trials, however, the parts become more tolerant, and the application can be borne, in the majority of cases, without trouble. Cocaine anæsthesia may be used in difficult cases, at least the first few times.[1] Each application of the current should last but a few seconds, and be repeated several times at short intervals. One sitting every day should be obtained if possible.

The current may also be applied by placing one pole on each side

[1] Sajous, *Lectures on Diseases of the Nose and Throat*, Phila., 1885.

of the neck externally. This method is very inferior to that just described. Better than it is electrical massage, which is carried out by placing the positive pole, thoroughly wetted, on one side of the larynx, and the fingers of the opposite hand (that holding the negative pole and in contact with the sponge) on the other side. The fingers, having become the conductors, are moved up and down and pressed into the surface of the neck, in the manner practised by masseurs. They must also be kept wet by occasional immersion in water.

Strychnine, nux vomica, and other nerve-tonics should be used, if possible, to assist the electrical stimulus. Strychnine is especially valuable, either by the mouth or hypodermically, beginning with $\frac{1}{60}$ grain at a dose three times a day, and gradually increasing until $\frac{1}{20}$ grain is reached. This dose cannot be taken by all patients, however, and the physiological effects of the drug should therefore carefully be watched.

Hysterical Aphonia.

The methods just described, and especially that illustrated on p. 443, may be used in the treatment of this affection. Response to the treatment often occurs at once; in some, however, nothing seems to cause return of the normal voice—most probably because of atrophy of the paralyzed muscles. Nerve-stimulants—valerian in the form of the elixir of the valerianate of ammonia, 1 teaspoonful night and morning—greatly assist recovery. Valerianate of zinc is another valuable agent, 1 grain being taken night and morning. Rabuteau's pills are indicated when anæmia is present, while nerve-tonics—strychnine, nux vomica, arsenic, and quinine—are of great assistance in the majority of cases.

Spasm of the Larynx.

This affection, variously termed laryngismus stridulus, spasm of the glottis, spasmodic croup, pseudo-croup, etc., presents as characteristic a sudden closure of the larynx, preventing the free inspiration of air, and greatly resembling the manifestations of true croup, from which it differs only in the fact that it is purely a nervous disorder. Like true croup, it is a disease almost invariably observed in children, and it offers very few points that enable the practitioner to establish a positive differential diagnosis within the short space of time at his disposal before the urgency of the symptoms demands active interference. Unless clear indications as to the origin of the trouble can at once be determined, it is best to proceed with measures calculated to meet the danger of suffocation, leaving the determination of its true nature until all immediate danger has been eliminated. Whatever be the actual condition, a warm mustard foot-bath or a general bath usually serves its purpose very rapidly, and if the little patient can

be made to take a drink of any warm liquid he may like, it greatly assists the suppression of the spasm by encouraging diaphoresis. Of equal value in both disorders is the production of emesis, either by titillating the back of the mouth with a feather or administering ipecac. The triturate tablets recommended by Northrup,[1] four or five of the $\frac{1}{100}$-grain tablets, given every ten to thirty minutes until four or five have been taken, are specially valuable for this purpose. When the spasm occurs in connection with difficult teething, making the diagnosis of true laryngismus almost certain, a few whiffs of chloroform or ether sometimes act favorably at once. The possibility of impaction of the epiglottis is to be remembered as a causative element, and should it be found free no harm will follow the introduction of the finger, which in case of impaction would have raised it without difficulty. The usual practices of dashing cold water in the child's face, slapping the back, applying a piece of ice suddenly to the back of the neck, had better be employed only when the diagnosis of simple spasm is assured. The application of a sinapism to the liver tends to prevent recurrence of the attacks. The bromides, chloral, opium, belladonna, etc. also act advantageously in this particular.

When all means fail to re-establish normal respiration and the dyspnœa continues marked, intubation should be practised. If instruments be not at hand to perform the operation, the trachea must be opened or a catheter introduced into the larynx to temporize until intubation instruments can be obtained.

Tumors of the Larynx.

A laryngeal neoplasm may be removed by means of caustics or the galvano-cautery, scraped off with the finger-nail, cut off with the knife or wire loop, or extirpated with forceps.

Chromic acid is doubtless the most easily managed escharotic, and is very efficacious in small, soft growths when the latter cannot be grasped with the forceps. It is also of great value for the cauterization of remnants of tumors which could not be caught in the grasp of the instrument, and to prevent recurrence. For its application a good instrument is that invented by MacCoy of Philadelphia.

The chromic acid dissolved by heat on the end of the covered probe is exposed only when the tip of the instrument is in contact with the neoplasm. Preliminary anæsthesia of the larynx with a 20 per cent. solution of cocaine renders the application comparatively easy. It should be used twice a week until every vestige of the tumor has disappeared.

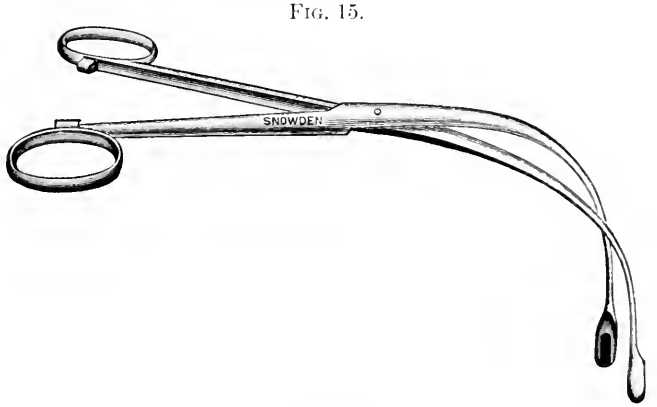
Removal with the finger-nail may be performed, according to Cohen, when soft tumors are situated high up in the upper portion of

[1] Keating's *Cyclopædia of the Diseases of Children*, p. 520.

the larynx. A small guarded probe-pointed bistoury mounted upon a suitable handle is employed by some operators, especially when the growth is located on the edge of a vocal band. But with this instrument, besides the hæmorrhage which follows incisions unaccompanied by crushing, there is danger of dropping the separated portion of the growth into the trachea. This disadvantage also characterizes operations with the cold or galvano-caustic snare. The latter instrument may, however, be employed to great advantage to cauterize the base of the tumor.

A great variety of laryngeal forceps for the removal of tumors are at our disposal, best known among which are Morell Mackenzie's, Fauvel's, Cuzco's, and Schroetter's. Before the introduction of cocaine as an anæsthetic Mackenzie's instrument was the most extensively used, owing to the sharper angle of its blades, which made it possible to perform the operation without much contact with the epiglottis. When the latter is thoroughly anæsthetized, however, an instrument curved like Fauvel's, as shown in the engraving, is preferable, the epiglottis

FIG. 15.



Fauvel's Forceps.

being held well up by the pressure of the blades, and permitting the reflection from the laryngeal mirror to illuminate the seat of operation much more brightly. Cuzco's forceps is another suitably-shaped instrument, its free and delicate action enabling it to be used without much motion of the hand.

A point of importance is the rapidity with which cocaine anæsthesia passes off in the larynx, owing to the copious flow of translucent lubricating fluid which the application of the anæsthetic occasions.[1] The fact that it lasts hardly ten minutes, even when a 25 per cent. solution

[1] See Sajous, *Lectures on Diseases of the Nose and Throat*, Philada., 1885, p. 387; *Transactions of Pennsylvania State Medical Society*, 1886; *Transactions of the Am. Laryngological Association*, 1888, p. 124; *Journal of the Am. Med. Assoc.*, May 3, 1890.

is employed, suggests that no time be lost after complete anæsthesia is obtained by repeated applications. The steps of the operation are as follows:[1] The tongue being held by the patient, and the mirror being in position, the forceps, previously warmed slightly, are introduced cautiously into the larynx, and as the tumor is grasped the claws are pressed against its base in order to sink them somewhat into the seat of implantation. The result of this manœuvre is to remove the tumor entire. As soon as the claws close on the growth the instrument is removed, its anterior portion being first raised slightly to detach the growth. Polished instruments when in position reflect the color of the surrounding surfaces, and are not easily seen. The writer, in order to follow the end of the instrument with his eye to the best advantage, blackens the claws by exposing them to fire. A bluish-black color is the result, which greatly contrasts with the surrounding parts. Slight bleeding usually follows the operation, but it soon ceases. The dyspnœa occasioned by the tumor is at once relieved. As far as the voice is concerned, its purity will depend upon the degree of integrity of the vocal bands. Spasm of the glottis has occurred during the removal of a tumor, but it is not likely that under cocaine anæsthesia this danger is to be feared.

When tumors cannot be reached through the mouth, the larynx may be opened anteriorly by an incision through the angle of the thyroid cartilage. The tumor is then removed through the opening thus made, and the wound is closed up.

Another operation is that proposed by Rossbach of Wurzburg, which consists in introducing a thin knife antero-posteriorly into the median line of the larynx from without, and amputating the tumor while the operation is watched in the laryngeal mirror held in the usual position. The tumor must, however, be very small and attached to the free edge of one of the vocal bands.

The spontaneous disappearance of laryngeal papillomata having occurred in several instances after tracheotomy had been performed by Oertel,[2] Hunter Mackenzie,[3] Garel,[4] and Eliasberg,[5] the latter author suggests that tracheotomy be considered a mode of treatment for these growths, the transfer of the atmospheric current from the larynx to the tube removing from the former all causes of irritation derived from that source.

The recurrence characterizing malignant growths precludes the employment of curative measures other than evulsion, involving at times the entire larynx. Extirpation of the larynx is so rarely fol-

[1] *Loc. cit.*, p. 388.
[2] *Volkmann's Sammlung. klin. Vorträge*, p. 2807.
[3] *Journal of Laryngology*, April and June, 1890.
[4] *Revue de Laryngol., d'Otol., et de Rhin.*, July, 1891.
[5] *Meditz. Obozren.*, No. 1, p. 46, 1891.

lowed by complete recovery as hardly to be warrantable. Tracheotomy performed early generally prolongs life several months, owing to the free respiration it procures and the rest it obtains for the diseased parts.

Comparative comfort may be secured for the patient by palliative measures. Lukewarm detergent sprays, by rendering the discharges liquid, enable the patient to rid himself of their presence without the painful scraping and hawking that would otherwise be required. Cocaine is here of very great use in the relief of pain and to enable the patient to take food. A 10 per cent. spray may be employed with advantage. When deglutition becomes painful, Bryson Delavan's alimentation bottle will serve a useful purpose to nourish the patient. The flexible catheter of small size, which replaces the ordinary stomach-tube, is introduced, not into the stomach, but simply below the pharyngeal constrictors, along either pyriform sinus, beyond the seat of trouble. Milk, soups, kommyss, etc. can easily be administered in this way. During the first few days the parts had better be anæsthetized with cocaine before introducing the flexible catheter. After that no resistance is offered and the patient can generally use it himself.

Foreign Bodies in the Larynx.

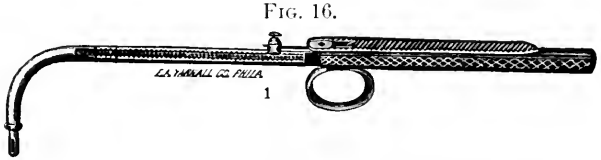
The spasmodic cough and dyspnœa immediately following the introduction of a foreign body into the cavity of the larynx usually make it impossible to take advantage of the great assistance that the laryngeal mirror would offer in ascertaining the location of the body, and in the measures adopted for its removal. The cough, however, usually soon stops, but if it continue and the dyspnœa be but slight, a spray of a 10 per cent. solution of cocaine will arrest it in a few moments. When this can be done a suitable forceps, by judicious manipulation, will withdraw anything that may have entered the laryngeal cavity.

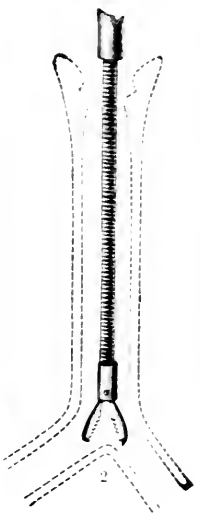
It is not always, however, that the opportunity to obtain suitable instruments presents itself. Assistance in many cases is needed at once. The simplest means are sometimes sufficient to dislodge an impacted body. A violent slap on the back, just as an expulsory effort is made by the sufferer, is often successful. In some the object remains over the aperture of the larynx, and can easily be removed with the finger. As we have seen under the heading of Foreign Bodies in the Pharynx, the epiglottis may be held down by the impacted body, so as completely to close the laryngeal aperture; the finger can also be used in this case. Inversion of the patient, by standing him on his hands while his feet are held up, may prove at once successful, especially if the object in the larynx has a certain amount of weight—a piece of money, a button, etc.

Sharp objects, such as pins, needles, tacks, etc., while penetrating the tissues and holding on with much force, do not cause dyspnœa, and, the parts being thoroughly anæsthetized, can be withdrawn without much trouble by means of a pair of forceps, such as Fauvel's or Cuzco's. The instrument shown herewith, especially constructed for this purpose and for the withdrawal of false membrane, can be made to reach even the bifurcation of the trachea if necessary. The smallest object can be grasped with it.

When, owing to the impossibility of withdrawing the foreign body, suffocation is threatened, tracheotomy becomes necessary. If the proper instruments are not at hand, the trachea may be opened with a penknife, and the wound kept open with bent

FIG. 16.





Sajous's Foreign-Body Extractor.

1, General view of instrument; 2, the foreign-body tip pushed into trachea.

hair-pins held in place by means of pieces of tape tied around the patient's neck; or the thyro-cricoid membrane may be divided, thus furnishing a sufficient opening for the admission of air until more decided measures can be adopted.

Opening of the trachea may also be performed to enable an object located there to be coughed out. In this case the wound should be longer than for ordinary tracheotomy to render spontaneous extrusion of the foreign body possible. Such an opening might also be made low down for the removal of foreign bodies lodged in either bronchus, the tracheal mucous membrane being thoroughly anæsthetized with cocaine, and a small mirror inserted to guide the introduction and withdrawal of the proper instrument, whose shaft may be armed with a tip arranged to grasp the object impacted.

DIPHTHERIA AND TRUE CROUP.

By J. CHALMERS CAMERON,[1] M. D., M. R. C. P. I.

General Considerations.

Of all the infectious diseases prevalent in this country, diphtheria is the most dreaded. It is dreaded because popular notions respecting it are hazy and indefinite. Even a cursory glance over its voluminous literature speedily shows that its treatment is too often random and erratic, being seldom based upon clear ideas respecting its nature and tendencies. The mind of the profession has been confused by the fierce fight between the localists and constitutionalists; and, although the battle is now virtually won, the dust and smoke of combat still envelop the battlefield and prevent a general perception of the true state of affairs. If there is one disease more than another in which a man should have convictions, and the courage to act upon them, it is diphtheria. Clear views, decision, and promptness in action have saved many lives that would have been lost by timidity and hesitation. Let me, then, at the outset, make my confession of faith, upon which I base treatment. Diphtheria is a local specific disease due to the presence and action of bacilli, characterized by a deposit of pseudo-membrane at the site of infection, accompanied by constitutional disturbances and followed by nervous symptoms due to the absorption into the circulation of a virulent chemical agent (toxalbumin), which is produced by the local development of the bacilli. Diphtheria and croup are identical. Though their identity has not yet been proven scientifically, yet clinically and practically the balance of evidence is in favor of this view. Those physicians who believe that true croup is diphtheria and contagious, and who base their treatment upon this belief, will succeed in saving life and limiting the spread of disease, when those will fail who soothe their own consciences and comfort anxious relatives and friends with the doctrine that croup is a local inflammatory and non-contagious disease, and neglect isolation and disinfection accordingly. If there is still a doubt, we should not allow it to make us careless in our practice.

If the treatment of diphtheria is to be rational, it must be based

[1] I desire to acknowledge my indebtedness for assistance in the preparation of this article to Dr. Birkett of Montreal, Junior Demonstrator of Anatomy in McGill University, whose services have been very valuable.

upon clear ideas respecting its etiology and pathology. I would recommend every one interested in this subject to study carefully Professor Welch's admirable address upon the *Causation of Diphtheria*. From a pathological point of view he comes to conclusions quite in accord with those derived from clinical experience, and which have long been my key to treatment.

To treat diphtheria understandingly and with success, one must be prepared to answer with no uncertain sound such questions as these: Is diphtheria primarily a *local* or a *constitutional* disease? Should its treatment be primarily local or constitutional? If local, when should we begin with constitutional measures? Is local treatment necessary in all cases, or does it in some cases or in some stages do more harm than good?

It is evident, therefore, that from the standpoint of treatment it is of the utmost importance for the practitioner to grasp the full significance of the fact that diphtheria is local before it becomes constitutional. According to Welch, diphtheritic bacilli develop only locally at the site of infection, and are found only in the pseudo-membrane, mostly on the surface, not even in the subjacent mucous membrane; they do not invade the tissues or circulation, but generate at the point of entrance a highly poisonous chemical substance, the absorption of which produces constitutional symptoms. If these views respecting the nature of diphtheria are correct, what course should one adopt when called to a case of diphtheria in the early stage? It seems reasonable to say that, after a diagnosis is made, vigorous local treatment is indicated to destroy the bacilli and prevent as far as possible the formation and absorption of toxic albumin, not forgetting at the same time to maintain the general strength. At the outset, therefore, local treatment is plainly the main indication, but as the case progresses general treatment assumes more importance; and as the later stages are reached chief reliance must be placed upon general measures, local treatment then being often harassing and fatiguing, doing more harm than good. If the case is not seen at the outset, the bacilli have had time to do their work, and general absorption of the chemical poison has taken place. Under such circumstances it would be folly to devote the same attention to local measures as if the case had been seen early. The fight is then no longer local, but constitutional, and its issue will depend upon the relative virulence of the poison and the resisting power of the organism. In such a state of affairs common sense would lead us to feed, stimulate, and support, strengthening weak points, anticipating and averting threatened dangers, while local precautions are taken to destroy the bacilli and prevent the body from being flooded with fresh doses of poison.

We have germicides in various forms for local treatment; we have

judicious feeding, stimulants, iron, digitalis, strychnine, mercury, etc. for general constitutional treatment. The practitioner who possesses tact to gauge his patient's strength through the various stages of the disease, to combine his local and general treatment according to the varying exigencies of the case, will find the treatment of diphtheria as rational and satisfactory as that of any other disease; but to succeed he must abjure empiricism and learn to treat his patient rather than the disease.

From what has been already said, it is evident that early and exact diagnosis is essential. The only pathognomonic feature of diphtheria invariably present is the specific micro-organism known as the Klebs-Löffler bacillus. The researches of Klebs, Löffler, Roux, Yersin, Welch, and others have abundantly proved that this bacillus is the causative agent in diphtheria, and that it produces at the point of infection a chemical poison whose absorption into the circulation gives rise to important nervous symptoms. It is needless, therefore, to describe minutely the diphtheritic pseudo-membrane and its microscopical appearances: full information upon such points can be found in any of the recent standard works on pathology. Suffice it to say that the diphtheritic membrane may appear in three different forms, but the severity of the case does not necessarily depend upon the presence of one form more than another, as any of them may be present in either a mild or a severe case. The forms are—

(1) Membrane lying on the mucous membrane of the pharynx, and removable without much injury to the underlying parts.

(2) Membrane involving the epithelium and upper layers of the mucous membrane.

(3) White or gray infiltration of deeper structures, sometimes resulting in necrosis.

But it is of practical importance to know something about the bacillus whose presence causes the disease, for a positive diagnosis in any doubtful case rests solely upon the detection of this micro-organism. In well-marked cases the clinical symptoms may suffice for diagnosis, but diphtheria is seen in so many varieties and in such varying degrees of intensity, and there are so many border-land and spurious cases during epidemics, that the practitioner often hesitates to pronounce a doubtful case to be diphtheria, and subject the family to all the anxieties, discomforts, and inconveniences of isolation and disinfection. Yet if he fails to adopt necessary precautions, even in the mildest cases, infection may spread, and he may be the unwitting cause of much suffering, and perhaps of even loss of life. It is therefore of the greatest practical importance for the practitioner to be in a position to determine whether the specific bacillus is present in any given case, and consequently whether the case is one of diphtheria or not.

To detect the Klebs-Löffler bacillus is a very simple matter for a

pathologist provided with suitable apparatus; but most general practitioners will find themselves unable to carry out the necessary investigation without special facilities. A good microscope provided with a high-power immersion lens and a hot-air chamber, which can be kept constantly at about blood-heat, are essential. If a small piece of membrane is removed and wrapped in paper, it may be sent to a competent observer and a positive opinion obtained within twenty-four hours as to the nature of the disease. For the complete examination of a suspected case three distinct procedures are required:

1. Examination of the membrane on cover-glass preparations;
2. Inoculation and culture of the bacilli on serum;
3. Inoculation of the culture bacilli into a guinea-pig to prove their pathogenic power.

The method of carrying out the examination need not be detailed here. Although it is necessary for accurate scientific investigation, a simpler method has been devised for clinical purposes, by which the bacilli can be detected through their mode of growth on serum, and the microscopical examination of the growing colonies. In direct examination of the membrane the bacilli may readily escape notice, or other pathogenic organisms may be confused with them. To carry out the cultures on serum, some hydrocele, pleuritic, or ascitic fluid is stiffened and sterilized at the same time by placing test-tubes closed with cotton-wool plugs obliquely in an oven heated to 75° C. for an hour, and afterward raising the temperature to 90° C. for half an hour. This higher-temperature exposure is repeated on three successive days in order to sterilize the serum. A platinum loop is applied to the membrane and drawn over the surface of the serum three or four times. Two or more tubes should be inoculated in this way without reinfecting the loop. The cotton plugs are replaced and the tubes put in an incubator at 35° C. to 37° C. If the specific bacillus is present, small flat grayish-white detachable growths, the size of pin-heads, are formed in *eighteen* hours. All other forms of bacilli take at least *twenty-four* hours, and the forms most likely to be present then are staphylococci, which are easily distinguished by their rounded form under the microscope. If the cultures succeed, the culture-growths should be examined microscopically with a $\frac{1}{12}$ oil-immersion lens, so as to avoid any possible confusion. For this purpose a drop of boiled distilled water is placed on a cover-glass which has been washed in alcohol and dried. One of the colonies is then touched with a platinum needle, and the drop of water spread evenly over the cover with the needle and allowed to dry in the air. The cover, held in a pair of forceps, is then passed three times through the flame of a Bunsen burner or spirit lamp, and stained with carbol fuchsin or any of the aniline dyes. The bacilli are now seen as short, thick rods about the length of tubercle bacilli.

The protoplasm is usually beaded and granular, while the ends of many of the rods show a club-shaped expansion like a drumstick. They are arranged in little clumps, often very close together.

Besides this specific bacillus, Löffler discovered in croupal pseudo-membranes a pseudo-bacillus, either alone or accompanying the true bacillus, which very closely resembles it, but has no injurious effects when inoculated into animals. There is some difference of opinion as to whether this is a distinct micro-organism or a modified, attenuated form of the specific bacillus. The weight of opinion seems to be in favor of the latter view, and if correct many obscure points in the history and treatment of diphtheria will be cleared up. The attenuated virus (pseudo-bacillus) is very widespread, and, having lost its virulence, in process of time may under certain circumstances regain it. It is consequently very important to use antiseptic sprays and gargles at the beginning of simple and scarlatinal anginas, especially if diphtheria is prevalent. In diphtheria epidemics many cases are sent to hospitals, especially from poorer districts, with pharyngeal symptoms, with or without membrane. Some of these are diphtheritic, others not; if non-diphtheritic and placed in the infectious wards, the patient is exposed to serious danger. The only way in which a positive diagnosis can be reached is to make a bacteriological examination and demonstrate the presence or absence of bacilli or pseudo-bacilli. In hospitals provision should be made for such examinations in doubtful cases, and the patient isolated till the diagnosis is positive. In the immense majority of cases, if a shred of membrane is taken while fresh and examined microscopically, a diagnosis can be made at once. As the case proceeds toward recovery the specific bacilli diminish in number, but may not entirely disappear until long after all traces of membrane are gone. The number of bacilli (true or attenuated) in any case, and their increase or decrease, may aid materially in prognosis.

Clinically, cases of diphtheria may be conveniently classified according to their frequency of occurrence as follows:

1. Pharyngeal;
2. Nasal;
3. Laryngeal;
4. Ocular;
5. Cutaneous;
6. Aural.

Diphtheria attacks all ages: it is fairly common under three months, and may even attack newborn infants. In some families there seems to be a predisposition to the disease. It is more apt to attack scrofulous children and those with large, prominent tonsils and numerous enlarged glands.

Pharyngeal Diphtheria.

Pharyngeal Diphtheria is by far the commonest form of the disease. The pseudo-membrane is found most frequently on the tonsils, less frequently on the posterior wall of the pharynx. From these situations the disease may extend upward, involving the nose, lachrymal duct, and Eustachian tubes, or downward, involving the trachea and its divisions. The period of incubation is one or two days, or even as long as fourteen days when the disease is directly communicated to a healthy mucous membrane. The onset is usually that of an ordinary sore throat, and if the throat be inspected simple erythema of the fauces may be observed, or localized erythema on either pillar or fauces. These symptoms may be preceded by a sensation of chilliness or even by an actual chill. In children the attack may be ushered in by convulsions. Following the chill and sore throat there are a feeling of lassitude and depression, with pain in the head and small of the back, a tired feeling in the legs, anorexia, and restlessness. There may be slight pain and difficulty in swallowing, a rapid pulse, and slight elevation of temperature. The late Dr. R. L. MacDonnell of Montreal was the first to observe that an early symptom in the majority of cases is loss of the knee-jerk. This symptom is found in all the varieties of diphtheria. Albuminuria may appear in any of the forms of diphtheria, and is not of itself to be regarded as of serious moment. As the case progresses examination of the pharynx shows that the catarrhal stage has been followed by the development of a thin yellowish membrane on the surface of either tonsil or both, or perhaps on the posterior wall of the pharynx. This membrane gradually assumes a dirty-gray color; its edges are sharply defined, and the surrounding portions of tonsils or pharynx have a deep-red or purplish hue. Here and there small hæmorrhagic points may be seen in some cases. The secretion from the mucous glands becomes more tenacious and slightly yellowish in color, and fetor of the breath is perceptible. The submaxillary and post-cervical glands enlarge and become tender at this stage of the disease. The temperature varies between the normal and 101° F. In ordinary mild cases the pulse is not much altered. The occurrence of a rash in the course of any form of diphtheria is not unusual. The rash is usually erythematous, like that seen in scarlet fever, although eruptions sometimes occur similar to those of measles, roseola, or urticaria. In the malignant type a purpuric rash, like that of purpura hæmorrhagica, is not uncommon. In the pharyngeal form we occasionally meet with gangrene: this condition is rare, and always associated with a severe type of the disease. It usually attacks the soft palate, and often results in the destruction of the uvula or one of the palatine arches. The tonsils

are rarely involved in the gangrenous process. Delirium does not usually occur in mild cases, but is almost invariably present in the graver forms. It is usually of a mild, wandering character. A severe attack is generally accompanied with rigors, a temperature of 105°–107° or subnormal, and is attended with nervous symptoms, as vomiting, convulsions, etc. If the membrane is forcibly or accidentally removed, it is rapidly reproduced. The lymphatics are very quickly involved, and the glandular and periglandular structure infiltrated. The neck on the affected side is much swollen, the membrane dark, and the odor very offensive.

Such being the clinical picture of pharyngeal diphtheria, what are we to do for our patient? Certain general directions are applicable to all forms of diphtheria: these will now be considered, special directions for special forms being given in their appropriate places.

Isolation.—A large, airy room should be selected, preferably at the top of the house and on the sunny side: it is difficult or impossible to isolate the patient completely on the lower floors. An open fireplace is an advantage. Carpets, curtains, mats, ornaments, and all unnecessary articles of furniture should be removed. A sheet kept wet with a disinfectant solution should be hung outside the door. Special attendants should be provided, and no others permitted in the sick-room. Dishes, towels, clothing, bedding, and utensils used in the room should be kept there, and not allowed to be carried through the house or used elsewhere. Dishes and utensils should be washed in the room or in a sink or wash-room not used by the other members of the household. Soiled clothes should be covered with a boiling disinfectant solution before being taken from the room, and great care exercised in washing them. The discharges from the nose or mouth should be received in an earthenware or glass vessel containing sublimate solution (1 : 5000), or in pieces of clean old soft linen, which should be burned immediately. The excreta should be received in glazed earthenware utensils containing sublimate solution (1 : 5000). Cats, birds, dogs, or other households pets should not be allowed in the room, for they are often the means of spreading infection. The room should be kept clear of flies, for they too have been accused of bearing infective particles from room to room and from house to house. The sanitary arrangements of closets, sinks, traps, and pipes should be closely examined and rectified if defective. Food should not be allowed to remain exposed in the sick-room; milk is particularly apt to absorb impurities from the air. The more thorough the precautions, the more likely will strict isolation be obtained.

Diphtheria is highly contagious, the infective bacilli being present in particles of diphtheritic exudation which are coughed, sneezed, or spat up; they are found also in the saliva, nasal mucus, and dis-

charges from a diphtheritic patch wherever present. They may even be breathed out, and thus infect the air. These infective particles readily attach themselves to the clothing of the patient or his attendants, to the walls, furniture, bedding, dishes, books, papers, and pets, or may float about in the dust and air of the room. It is manifestly of the utmost importance to collect and destroy immediately those discharges which are the vehicles of infection, and keep the air pure by thorough ventilation. As a further precaution a disinfectant solution should be kept constantly vaporizing in the room. A small coal-oil stove is better than a gas stove for this purpose. The following formula is useful and the odor is not unpleasant:

℞. Ol. eucalypt.,
Acid. carbolic., āā, ʒvj;
Spts. terebinth., ad ʒvj.—M.
Sig. One table-spoonful in a pint of water.

In the immense majority of cases infection takes place by contact, though it may occur by other means, such as air, water, and milk. A little thought should enable the practitioner to adapt his measures for isolation and disinfection to the varying circumstances and conditions of the case. It is possible, even in the poorest homes and under very unpromising conditions, to adopt measures which will limit the spread of the disease.

If great care is not observed in collecting or destroying infective discharges as soon as possible, ventilating the sick-room, changing and disinfecting bedding and clothing, the patient may reinfect himself and suffer from repeated relapses. During convalescence the patient should have a change of apartment if possible, one for night and another for day, so that the rooms may be aired and fumigated when not in use. If repeated relapses occur or the membrane persists in reforming, there is probably some focus of infection which has not been recognized and destroyed. Upon removal to new quarters in a new locality improvement often sets in rapidly.

As the virus of diphtheria remains active in the mouth for a long time after the patient is convalescent, he must never be allowed to mingle with others till all risk of infection is over. Particularly is this the case with regard to school-children. It is difficult to fix a time-limit in this respect. It has been shown that at least eight days must elapse after the disappearance of all local manifestations. But just here comes the difficulty: When can local manifestations be said to have ceased? In the nasal form of diphtheria an acrid discharge often persists for weeks, or even months, after other symptoms have disappeared and the child is running around. I am sure that I

have more than once been able to trace the source of infection back to such a cause. In cases of doubt it would be safer to examine the discharges repeatedly for the presence of bacilli before giving a clean bill of health. Löffler mentions four weeks from the beginning of the attack as the proper time for children to be kept out of school. This is evidently only a rough guess, and cannot safely be adopted as a working rule in practice. In my opinion, very little reliance can be placed upon an average time limit when applied to individual cases. Each must be judged upon its own merits, and the only safe way to decide that a child will no longer scatter infection is to ascertain by bacteriological examinations of the affected parts and the discharges therefrom whether the specific micro-organism has disappeared. If so, then the greatest care should be taken to see that the nails, hair, ears, and body of the patient are thoroughly clean, and that no clothing is worn which has been exposed to infection. The methods of disinfection of the patient's clothing and bedding have been described in the article on Disinfection in Vol. I.

Feeding.—As the tendency of diphtheria is to debilitate, and as recovery often depends upon the strength and staying power of the patient, it is obvious that the greatest care must be taken from the very outset to keep up nourishment. As a rule, solids should be avoided and the most nutritious and digestible liquids selected. It is needful sometimes to give nourishment in concentrated form when the stomach is irritable, or to peptonize it, or even to feed wholly or partially by means of enemata. Milk and cream, alternated with beef- or chicken-broth or jelly, should be given regularly and at frequent intervals. Raw eggs, eggs beaten up with milk or tea, the whites of two or three eggs beaten up with milk, and home-made ice-cream, will be found useful. Those foods should be selected which contain much nourishment in small bulk; it is not safe to defer too much to the whims and fancies of the patient. The struggle may be short and sharp; therefore nourishment must be given and strength maintained. Feeding is an important part of the treatment, and the physician should not content himself with vague or indefinite directions about diet, nor should he entrust such an important matter to parents or nurses, however skilful; he should lay out a diet-table as carefully as he prescribes medicines, and should at each visit satisfy himself that his directions are being carried out. It is my firm belief that many children treated medicinally after the most approved methods have been allowed to perish through neglect in this respect. In the early days of their practice physicians are apt to think too much of drugs and too little of food and hygiene.

Medicinal Treatment.

The object of *local* treatment is to destroy the bacilli and their products; the object of *internal* treatment is to support the general strength and neutralize or obviate the effects of the toxic albumin which is being absorbed. Hosts of drugs have been recommended singly and in combination to accomplish these ends. A new treatment is proposed, is highly vaunted, tried for a time with more or less success, and discarded for some fresh novelty. In a few years perhaps it is resuscitated, and in a new dress or with new sponsors is launched forth again, to run the same course. Some drugs which were fashionable fifteen years ago are being vaunted to-day as new specifics for diphtheria. Truly history repeats itself. Without giving formulæ or entering into details the following drugs and methods of treatment may be mentioned:

Acetic acid (Uytterhoeven, 1865).
Carbolic acid (Bunce, 1873).
Citric acid (Caspari, 1877).
Hydrochloric acid (Martin, 1858).
Lactic acid (Dureau, 1868); advocated recently as a new remedy.
Salicylic acid (Rickrath, 1876).
Sulphurous acid (Yeomans, 1881).
Sulphuric acid, locally.
Tannic acid (1868).
Alum (Bretonneau, 1827).
Nitrate of silver, in strong solution and solid stick (Authenac, 1828, and Blanchard, 1869).
Cauterization (Beaupoil, 1877).
Chloral (Carney, 1879).
Corrosive sublimate (Billotti, 1876).
Cubebs and copaiba (Bergeron, 1870).
Chlorine (Alford, 1859).
Oil of eucalyptus (Mosler, 1879).
Galvanism (Schwanda, 1871).
Guaiac resin (Day, 1870).
Mercurial ointment, inunction (Ebert, 1866).
Mercury fumigations (Corbin, 1881–82).
Ice (Bleynie, 1878).
Iodine, inhalation (Curran, 1867).
Perchloride of iron, locally and internally (Rey, 1861).
Monsel's solution (Fernsworth, 1864).
Iodoform (Defaix, 1881–82).
Oxygen gas (Robinson, 1879); now used in the form of hydrogen peroxide.

Pepsin, acidulated solution (Doughty, 1868).

Papaine (Bouchut, 1881).

Pilocarpine (Payrandeau, Paris, 1881); internally or hypodermically.

Potassium bromide, local application (Peyraud, 1880).

Potassium permanganate, hypodermically (Brown, 1879).

Quinine sulphate, as a gargle (Brakenridge, 1875).

Sodium chloride (Butth, 1880).

Sodium bicarbonate (Roustan, 1861).

Sodium sulphocarbolate (Anthony, 1876).

Sodium benzoate (Clossen, 1879).

Sodium hyposulphite (Burd, 1880).

Rectified spirits (Brichetean, 1864).

Sulphur (Abelin, 1869).

Tonsillotomy (Bigelow, 1860).

Vichy water (Baron, 1851).

Among the drugs most vaunted as solvents of the membrane may be mentioned papayotin, trypsin, pepsin, and peroxide of hydrogen. The last mentioned is by far the most serviceable and reliable. Corrosive sublimate, first used by Billotti fifteen years ago, is highly esteemed by some and denounced by others. Its chief value is in the treatment of laryngeal diphtheria, and it will be referred to under that heading.

Dr. Jacobi says that diphtheria cannot be treated by any other drug as well as by the bichloride, as it is readily soluble and counteracts the specific poison—in Germany it is freely used. Rennert[1] reported recently the results of a year's treatment with it. His formula is—

Hydrarg. chlor. corrosiv.,	1 part;
Acid. tartaric.,	5 parts;
Aquæ,	1000 parts.

Wrap a wad of cotton (1 in. long, $\frac{1}{2}$ in. thick) about a pincette, and wipe off the diphtheritic patch. Swab the bleeding surface thoroughly with the solution: sometimes three to five wads are required for each side of the throat before the membrane is wholly removed. Repeat the applications every six to twelve hours. When the tonsils are clear, use a larger wad to swab over the entire pharynx. The acid solution of the bichloride acts more intensely than the simple solution. The fever usually declines after the second application. In nasal diphtheria a boric-acid solution (3 per cent.) is used alternately with the sublimate applications. Rennert reports 62 consecutive recoveries, but to be successful he says this treatment must be carried out

[1] *Berlin. klin. Woch.*, Aug. 26.

thoroughly. In none of his cases were there any symptoms of mercurial poisoning.

In England the biniodide-of-mercury treatment advocated by Dr. C. R. Illingworth has been highly praised. The membrane usually disappears in two to five days, except in very severe cases. The iron-and-chlorate-of-potash mixture is substituted after the membrane has gone. Dr. Illingworth's formula is—

R. Liq. hydrarg. perchlor.,	f℥iij ;
Potas. iodid.,	grs. x ;
Ferri et ammon. citrat.,	grs. xx ;
Syrupi,	f℥iv ;
Aquæ,	f℥ij.—M.

Sig. One tea-spoonful every two hours (for a child of two to four years).

Sir Morell Mackenzie places great faith in salicylic acid in the treatment of diphtheria, and the following is his favorite prescription :

R. Acidi salicylici,	℥iss ;
Alcoholis,	f℥ijss ;
Aquæ destillat.,	q. s. ad f℥vj.—M.

Sig. One to two tea-spoonsful, to be given every three hours.

At the recent London meeting of the International Congress of Hygiene (August, 1891), Mr. Turner of Gloucester reported very satisfactory results from the *paraffin* treatment of diphtheria. The membrane is scraped or peeled off, and paraffin applied to the raw surface every hour by means of a large camel's-hair brush. The throat usually gets well in one or two days. The applications are made less frequently as improvement goes on, but are continued occasionally for two or three days after the entire disappearance of the patches. Tonsillitis was found to follow in some cases. The ordinary paraffin used in lamps is employed ; it should not be allowed to remain exposed to the air, but should be poured from the can when about to be used. The curative effects are probably due to the action of the higher hydrocarbons present in paraffin. If the liquid form is found inconvenient, it may be semi-solidified by agitating it with a soap or saponin. It was suggested to make a paraffin ointment by agitating paraffin with 10 per cent. of warm water containing 1 per cent. of saponaria bark. The ointment could be brushed on the throat in larger quantity, and would adhere better. It was also suggested to alternate the ointment applications with a vapor or spray of paraffin. The method is worthy of trial.

Without entering into the various merits and demerits of the numerous drugs and plans of treatment now in vogue, it will suffice to outline a rational treatment suitable for most cases. Of course, as I said before, each case must be treated upon its own merits: symptoms must be treated as they arise, threatening danger guarded against, and the treatment modified or changed according to circumstances. It is impossible to treat diphtheria successfully with two or three ready-made prescriptions; it is the patient who must be treated, not the disease.

Locally.—Every four hours the throat should be sprayed with a 10-volume solution of peroxide of hydrogen, either pure or diluted with an equal quantity of water. One table-spoonful of the undiluted peroxide may be used in the day for infants and children under three years. Between three and ten years double the quantity or more may be sprayed. The best form of atomizer is the water-oil atomizer made by Ellis and Goltermann: the nozzles are of vulcanite, and either watery or oily liquids may be used. The same firm makes a cheap atomizer for the throat only, which is sufficient for ordinary nasal and pharyngeal cases. Both forms have a single bulb, but give a continuous spray; they are quite as efficient as the double-bulbed instruments, and are more easily worked. Another good model is the "magic atomizer," No. 30, manufactured by the Davol Rubber Co., Providence, R. I. The tubes and nozzles are of hard rubber, not metal, and the spray is very fine, each compression of the bulb atomizing about four or five minims. It is therefore easy to calculate how many compressions of the bulb will be required to atomize a certain amount of liquid. Coarse sprays are useless, and often harmful when powerful drugs like the bichloride of mercury are used for some length of time. It is well to test the atomizer and ascertain its power and capacity before laying out directions for local treatment. Occasionally corrosive sublimate spray (1 : 5000) seems to have a more powerful effect on false membrane than the peroxide, and in some cases both kinds may be used with advantage alternately or day about. In children who will gargle it is well to alternate the spray with a gargle of sublimate solution (1 : 5000). In some cases, where the spray is not well borne or cannot be readily applied, and when the membrane is thin and situated only on the tonsils, the insufflation of sulphur is useful. If an insufflator is not at hand, a small tube of letter-paper, having the calibre of an ordinary lead pencil, will answer the purpose very well. The tonsils having been brought well into view, a little sulphur can be blown upon each; this should be repeated every hour or two. When the child can gargle it is well to use a warm gargle of chlorate of potassium and glycerin before applying the sulphur:

℞. Potassii chlorat., ʒj;
Glycerini, ʒij;
Aquæ, ʒviij.—M.

It is important in all these throat applications to see that food or drink is taken *before* the application, not *after*. It is well to draw up a time-table for the use of the attendants, marking at each hour or half hour what is to be done, taking care to arrange the proper sequence of food, medicine, and local applications. This is a point which is too often neglected in practice, and it is one of great importance. The stomach is apt to rebel against frequent feeding and the administration of drugs like iron, unless the greatest care is taken to spare it as much as possible. If the stomach gives out before the disease is well mastered, the chances of recovery become much impaired. Any tenderness of the submaxillary and post-cervical glands may be relieved by the application of hot linseed-meal poultices or hot fomentations every four hours.

Internally.—In the internal treatment of diphtheria there is no drug so generally useful as tincture of the chloride of iron. It is not only a good general tonic, but also a powerful stimulant to the nervous system. A convenient way of giving it to an infant one year old is as follows:

℞. Tinct. ferri chloridi, ♏iss;
Acidi phosphorici dilut., ♏j;
Glycerini, ♏ij;
Spts. chloroformi, ♏j;
Aquæ, q. s. ad fʒj.—M.

Sig. To be given every three hours, well diluted with water.

To older children the iron may be given in much larger doses. Children of two and three years often bear 5 to 10 minims. It is open to question, however, whether the heroic doses recommended by some physicians are needful or advisable. When iron is pushed too far the stomach is apt to rebel, and then food is rejected as well as the medicine. It is safer to be content with moderate doses at short intervals, always given well diluted and not too close to food. Chlorate of potassium is highly extolled, and may be given alone or combined with iron. Jacobi has drawn attention to the injurious effects of large doses of this drug upon the kidneys. He places the maximum daily dose at 20 grains for a child of one year or under, 30 grains for one of two or three years, 90 to 120 grains for an adult. Even these doses he considers dangerous if persisted in for many days.

The patient should be kept in a recumbent position as much as

possible, and free from violent exertion or excitement. Food and medicine may be administered with a feeding-cup without disturbing the child at all. Local applications must be made quickly and gently; unnecessary examinations of the throat should be avoided. When an application is to be made, the nurse should not permit the child to rise, but should herself gently raise him into the proper position. Heart failure is one of the pressing dangers; hence every means must be taken to spare the heart and keep the circulation tranquil. The condition of the pulse and the first sound at the apex of the heart should be carefully watched for signs of failure.

Stimulants are indicated in diphtheria almost from the outset; it is better to err on the safe side and give them too early rather than too late. Champagne is the best at the outset or when the stomach is irritable or in the case of young infants. Half a teaspoonful to a tea-spoonful may be given to an infant every hour or two. In administering stimulants the object is to keep a constant moderate effect; they should be given, therefore, in small and oft-repeated doses. If large doses are given at long intervals, the desired effect is not produced; indeed, they may do positive injury; for the large dose causes needless exaltation, followed inevitably by depression; and it is in the stage of depression that the heart is apt to fail. When champagne is not available or is unsuitable, good old brandy or whiskey should be used; wines, as a rule, are uncertain, and had better be reserved for convalescence. The dose of the stimulant should be regulated according to the effect on the pulse. A dose which is sufficient to-day may be inadequate to-morrow, or perhaps a large dose which is imperative to-day may be reduced to-morrow. There should be no hard-and-fast rule as to the quantity of stimulants employed, any more than as to the dose of iron or digitalis. If the heart shows signs of weakness and the pulse becomes small, compressible, and irregular, digitalis is required. In diphtheria large doses are borne well, and the drug should be pushed till the heart begins to respond. For an infant of one year 1 minim of the tincture may be given every two or three hours; for an adult, 5 or 10 minims. The dose must be regulated by circumstances, but it must not be forgotten that the action of digitalis is apt to be cumulative, and large doses should not be kept up for any length of time.

Nasal Diphtheria.

Nasal diphtheria may be either primary or secondary. When secondary, the disease has extended up the posterior nares from the pharynx. The invasion of the nasal tract may be suspected when nasal respiration is obstructed and the patient breathes chiefly or wholly through the mouth. A thin, ichorous, muco-purulent discharge appears

in one nostril or both; small excoriations and ulcerations form at the entrance of the nares, on the upper lip, or wherever the discharge is allowed to rest. Nasal diphtheria is especially apt to occur in children who have more or less large collections of adenoid tissue in the vault of the pharynx. Such children are usually mouth-breathers, or become so when they take the slightest cold. They snore at night, and their sleep is restless and broken. When they contract diphtheria, it usually spreads rapidly to the nares, and seriously complicates the case. Epistaxis is apt to occur.

The cervical glands soon become involved, as the lymphatics from the nose empty into them. Glandular enlargement and constitutional symptoms appear much sooner in nasal than in pharyngeal diphtheria. Local treatment is more difficult to apply, and cannot be made as thoroughly; the prognosis is much graver. Great attention must be paid to local cleanliness. Gentle douching, spraying, or syringing with weak solutions of chlorate of potassium and glycerin, or borax and glycerin, to which a little carbolic acid may be added, will be very soothing and improve the character of the discharge. The peroxide of hydrogen spray is here also of great benefit, but there is one practical hint which may be given respecting its use. The nozzle of the atomizer should be kept exactly in the middle line of the nares, otherwise it may impinge upon the septum or inferior turbinated bone and bring on epistaxis. There is usually not much difficulty in removing portions of the diphtheritic membrane from the nose. This should be done as far as possible, taking care to avoid all rough manipulations.

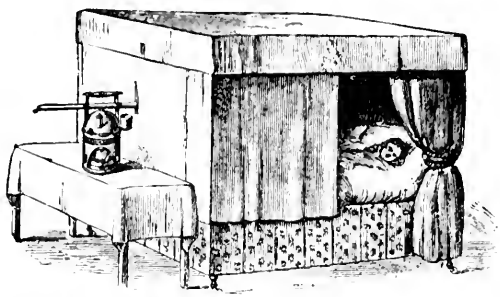
The general treatment is on the same lines as in pharyngeal diphtheria.

Laryngeal Diphtheria.

Laryngeal diphtheria may be either primary or secondary. The more common form is the secondary: it is then an extension of the morbid process from nose or pharynx downward. The onset of laryngeal diphtheria is recognized by a harsh, dry, shrill, or hoarse muffled cough. The voice is husky, weak, and sometimes almost inaudible. The breathing is embarrassed, intermittingly at first, constantly afterward. Associated with the cough is a spasmodic closure of the glottis and a temporary increase of dyspnœa. If a laryngoscopic examination be made in this condition, the false and true vocal cords will be found intensely hyperæmic and swollen, with patches of membrane here and there; in some cases the whole interior of the larynx is covered with a dense, tough, grayish membrane. In this form of diphtheria the use of steam as an inhalation is very beneficial. With adults the steam atomizer may answer the purpose, but with children a tent should be constructed over the cot, so that the child may breathe a steam-saturated air without effort. The tent should not be wholly closed, but

ample space left open on one side for ventilation. The air in the tent is kept saturated with steam by means of a tube from a croup-kettle.

FIG. 17.



The tent is easily constructed by fixing an upright post, three feet long, to each post of the bed: upon these rest four cross-bars, and over this skeleton frame sheets are placed. The steam may be admitted into the tent as shown in diagram.

Care should be taken that the nozzle which conveys the steam is not allowed to come too close to the child; serious burns and scalds have resulted from neglect of this precaution. The steam may be used plain or medicated with some disinfectant. Oil of turpentine is probably the best: 1 table-spoonful may be added to the water in the kettle every two or three hours. Oil of eucalyptus (1 drachm every two or three hours) is highly spoken of by some. Carbolic acid is still used, but the risk of absorption and the damage which it may do to the kidneys should make us careful about using it for any length of time. Lime-water is much esteemed by some as having a powerful solvent effect upon the membrane. Vapo-cresoline is a popular remedy, and is thought to be very powerful, probably because it has such a villainously bad smell. The tar treatment has also been highly extolled. A pot of tar is kept heated in the room by means of a spirit lamp. It is efficient in many cases, but is messy and dirty.

Local applications, so useful in nasal and pharyngeal diphtheria, are useless here, and should be discontinued when the nose and pharynx are clear. With regard to the value of emetics in laryngeal diphtheria there has been much difference of opinion. On *a priori* grounds one would hesitate to administer a powerful depressant in a disease the danger of which is depression. O'Dwyer says all that can safely be said in favor of emetics; his opinion is as follows: "In what may be called sthenic cases, when the dyspnœa becomes urgent and abiding, or, in other words, when it is time to operate, prompt, vigorous emesis, such as is produced by the yellow sulphate of mercury, often gives marked relief, which sometimes lasts long enough to render a repetition of the vomiting safe if stimulants and nourishment be administered in the interim. By this means I have succeeded in getting a good many cases through, especially those that had been placed on the bichloride

treatment at the commencement of the disease, that would otherwise have required intubation."

The internal administration of bichloride of mercury is advocated by many, and has in their hands proved very beneficial. The dose for an infant of one year is $\frac{1}{150}$ to $\frac{1}{100}$ grain every hour. It is best administered in milk. Its effect should be carefully watched, and it should not be continued longer than four days.

Notwithstanding the high praise given to this drug by its friends, it does not seem to produce such uniformly good results as tincture of the chloride of iron. A formula for the administration of this drug has already been given. It may be administered continuously and with benefit through all stages of the disease without untoward effects, whereas mercury is found useful only in the severer forms, can be continued only a short time, and must be carefully watched. The chief drawback to prolonged iron treatment is its tendency to produce irritability of the stomach. But if it be given sufficiently diluted, and not too close to food, that disadvantage will be reduced to a minimum.

It is in the laryngeal form of diphtheria that the patient requires the most careful watching. If obstruction to the breathing increases, as evidenced by the aggravation of the symptoms already mentioned, it becomes our duty to interfere and relieve the obstruction mechanically if possible. This may be done in two ways—by *intubation* or by *tracheotomy*. For surgical measures to have a fair chance of success early interference is necessary. The patient must not be allowed to drift along into an almost moribund condition before we operate if we expect any good results from the operation. When the breathing has become stridulous, inspiration difficult, the clavicles, sternum, ribs, and diaphragm retracted; when the child is tossing about, extending its neck in the vain effort to get air; when the lips are cyanotic and the face of an ashen hue,—we may give temporary relief by operating, but the chances of ultimate recovery are not as good as if we had interfered before the onset of these grave symptoms. It is a serious matter to decide upon operative measures in these cases, but it is my firm belief that it is safer to err upon the side of early operation, especially if the operation is to be intubation.

Having decided to interfere, which operation should be selected, intubation or tracheotomy? After going carefully over the opinions of most recent writers upon this question and weighing the "pros" and "cons" of each method, it seems that opinions are pretty evenly divided as to their relative value. Statistics show very little difference in the results. Intubation gives $26\frac{2}{5}$ per cent. of recoveries, and tracheotomy $26\frac{1}{2}$ per cent. (Stern). The indications which would be helpful in determining the choice of operation have been well summarized by Stern, as follows:

"1. All things being equal, I would always intubate when the patient is under three and a half years of age.

"2. Between the ages of three and a half and five years I would be regulated of course by individual circumstances, with a preference for tracheotomy.

"3. Over five years of age I would perform tracheotomy.

"4. In adults I would never tracheotomize, but willingly test intubation.

"5. Amongst poor people, irrespective of age, I would always intubate. While it sounds harsh to draw such class distinctions, good reasons are forthcoming. The general results of intubation are about equal to those of tracheotomy. Skilled attendance, such as is always required after tracheotomy, can only be procured for considerable purchasing power, and is in consequence only available where people have means. While the operator himself may be willing to give his own valuable time, he may owe to other patients attendance that may be of as much value to them as to the child operated upon.

"6. Intubation should never be performed at any age where there is a strong probability that the trachea is crowded with membrane.

"7. Where skilled assistants cannot be obtained intubation should always be practised."[1]

It now remains to detail the method of performing these operations.

Intubation.—O'Dwyer's method of operating has not been improved upon; here is the description of his operation in his own words:

"*The Instruments.*—A set of intubation instruments consists of six tubes, each supplied with a separate obturator, an introducer (Fig. 21), extractor (Fig. 20), mouth-gag (Fig. 18), and a scale (Fig. 19). The obturator when in position projects a little beyond the lower extremity of the tube, and is rounded off into a probe point to prevent pushing down pseudo-membrane and injuring the tissues of the larynx. It also serves as a means of attachment to the introducer. The numbers on the scale indicate the years for which the corresponding tubes are suitable. The smallest tube when applied to the scale will reach the first line, marked 1, and is suitable for children of one year and under. This tube can be used with children of two years with perfect safety, as far as slipping into the trachea is concerned, but the probability of its being coughed out would be great. The second size reaches the line marked 2, and is suitable for children between one and two years old. The third size is for children between two and four years old, and the next size for children from four to seven years old. The next size, reaching the line marked 8–12 on the scale, is for children up to twelve years of age, but not after puberty, as the

[1] Max Stern, *Trans. Ninth International Medical Congress*, vol. iv., 1887.

sudden increase in the size of the larynx at this time would render it liable to pass through into the trachea. The largest size is intended

FIG. 18.

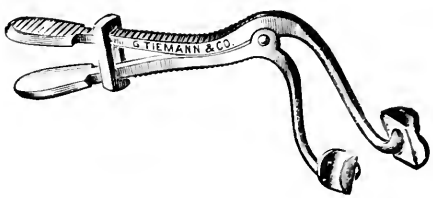


FIG. 19.

FIG. 20.

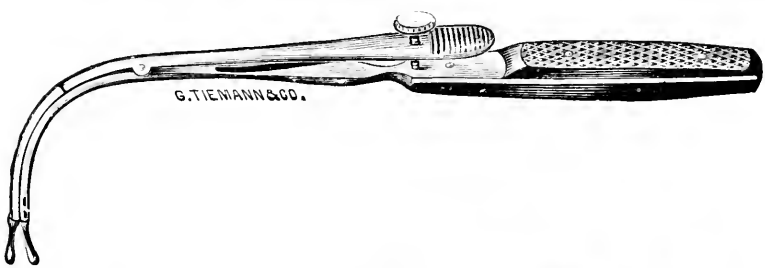
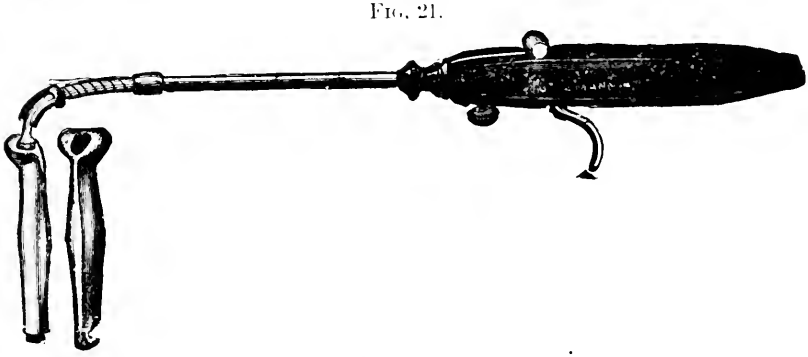


FIG. 21.



Intubation Instruments.

for those children whose larynx is so large that the No. 5 tube is not retained.

"The female larynx in children, as in adults, is smaller than the male, which should be taken into consideration in selecting the tube, as well as the size of the child compared with its age. For instance, in a small delicate girl of four years a No. 2 tube would be the proper one; while, on the other hand, in some boys of three and a

half years it would be advisable to use the 5–7 size, especially if the case is a considerable distance from you, and coughing out the tube would entail some danger and a great deal of inconvenience.

"When the proper tube is selected for the case a fine thread of braided silk is passed through the small hole near its anterior angle, and left long enough to hang out of the mouth, its object being to remove the tube should it be found to have passed into the œsophagus. The obturator is then screwed tightly to the introducer and passed into the tube. It is well to push off the tube once or twice before using it, to see that everything works smoothly.

"*Method of Introducing the Tube.*—The following is the method of introducing the tube, which is done without the use of an anæsthetic: The child is held upright in the arms of the nurse, with its head on her left shoulder, to avoid interfering with the mouth-gag, and the arms are secured to the sides, either by being held below the elbows by the nurse or by wrapping a sheet around the body. The legs should be secured between the nurse's knees. The gag is inserted in the left angle of the mouth, well back between the teeth, and opened as widely as possible without using undue force. An assistant holds the head, thrown somewhat backward, while the operator inserts the index finger of the left hand to elevate the epiglottis and direct the tube into the larynx. The instruments should be worked in the median line, the operator facing the patient squarely. The handle of the introducer is held close to the patient's chest in the beginning of the operation, and rapidly elevated as the tube approaches the glottis. Very little force is necessary to overcome the obstruction, and if the tube does not enter the larynx easily, it should be withdrawn and another attempt made. It should be pushed well down into the larynx before it is detached from the obturator; and while removing the obturator it is necessary to keep the finger in contact with the head of the tube, to prevent it being also withdrawn. The string should not be removed until the dyspnœa is relieved and the operator is certain that the tube is in the larynx. In some cases the string causes so very slight an amount of irritation that I allow it to remain for ten or fifteen minutes, to excite more cough and thus expel the accumulated secretion and overcome any collapse of the lung that may exist. When the thread is withdrawn the finger must be kept in contact with the tube to prevent its being also withdrawn. In removing the tube the child is held in the same position, but the head is not thrown quite as far back. The finger which is used as a guide for the extractor is brought in contact with the head of the tube, and then pressed toward the patient's right, in order to uncover the aperture and allow the extractor to enter in a straight line. Continuous pressure with the thumb is made on the lever above the handle while the tube is being withdrawn.

"Owing to the small aperture of the tube compared with the size of the larynx, the extraction of the tube is more difficult than its insertion. It is during this part of the operation that the greatest amount of injury is liable to be done to the larynx by pushing the instrument down outside the tube and removing it forcibly with the blades widely open. It requires no force whatever to remove a tube from the larynx, and if any resistance is felt, it will be found that the point of the extractor is not in the tube, but caught in the surrounding tissues. To reduce this danger as much as possible, I have added a regulating screw, which prevents the blades from opening wider than is necessary to hold the tube firmly. It can be adjusted to suit a tube of any size.

"What are the evidences of the tube being in the larynx? The first thing noticed is that cough sets in which has a decidedly tubal character, and once heard is not readily forgotten. The more or less cyanotic condition usually disappears, and the child becomes more quiet. When the tube has been passed into the œsophagus instead of the larynx, this is known by the string which is attached to the tube becoming gradually shorter, by the absence of much spasmodic cough, and the non-relief to the dyspnœa.

"Being satisfied that the tube is in the larynx, and that the condition of the child is satisfactory, the string may be removed, and the next step is the careful feeding of the patient. To avoid the tendency of food finding its way into the larynx, it is well to adopt Waxham's plan of feeding young children under such circumstances; and that is to so place the child that its head is lower than its feet, fluid food being administered by means of an ordinary feeding-bottle to which a rubber nipple is attached. To alleviate thirst, Waxham recommends cracked ice and ice cream. Stimulants should under these circumstances be administered only by enemata."

Another important question is, When shall the tube be removed? In answering this question we are again indebted to O'Dwyer for the answer. "The proper time for removing the tube from the larynx," he says, "will depend upon the age of the patient, the character of the disease, whether of slow or rapid development, and the progress of the case. The younger the patient, as a rule, the longer the tube will be required. In children under two years it is better to leave it in for seven days. When the disease has developed slowly, and has therefore run a greater part of its course before calling for operative interference, the tube can be dispensed with earlier, sometimes as soon as the second or third day. If the case be at such a distance as to render it impossible to reach it in a reasonable time, it is safer, if progressing favorably, to leave the tube in position for seven or eight days, and the exceptions are few in which it will be necessary to reinsert it after this time. The tube

should always be removed on the recurrence of severe dyspnœa, because it is sometimes impossible to ascertain with certainty whether it be partially obstructed or not. The best evidence to the contrary is a good respiratory murmur or numerous râles over the lower portion of the lungs. The development of a high temperature, especially if accompanied with any considerable amount of bronchitis on the third or fourth day, is a sufficient reason for removing the cannula, as it can sometimes be permanently dispensed with as early as this; and even if left out only for a few hours without urgent dyspnœa, is of great benefit, as it affords an opportunity to unload the bronchi of secretions by permitting complete closure of the glottis, and thus giving full effect to the act of coughing.

"In those cases which refuse nourishment after intubation, or that cannot be induced to take a sufficient quantity, it is useless to remove the tube for the purpose of feeding, unless it has been in long enough to give some reasonable hope that its further use will not be necessary, as it is difficult to convince children for some time that they can swallow any better than before. If no dyspnœa recurs in half an hour after the extraction of the tube, it is safe to leave the patient if not at too great a distance to be reached within two or three hours."

Tracheotomy.—What instruments are required for this operation? One good straight-back scalpel (Fig. 22), grooved director with aneur-

Fig. 22.

Fig. 23.

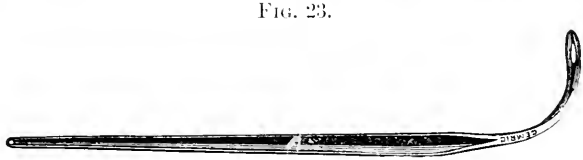


Fig. 24.

Fig. 25.

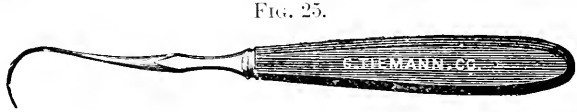


Fig. 26.

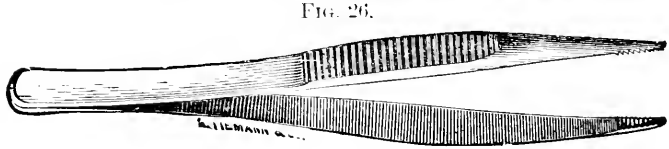
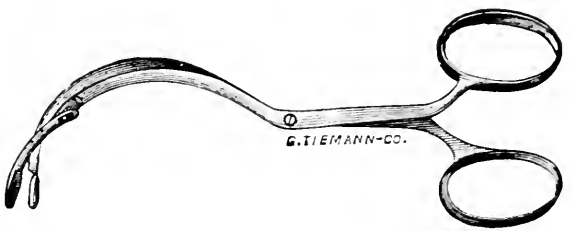
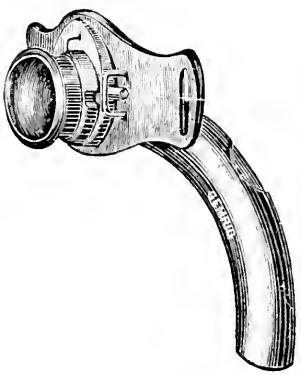


Fig. 27.



ism-needle handle (Fig. 23), two blunt retractors (Fig. 24), one sharp hook (Fig. 25), dissecting-forceps (Fig. 26), tracheal forceps to remove membrane from the lumen of the trachea (Fig. 27), half a dozen Péan's artery-forceps, carbolized catgut ligatures (No. 2), one straight needle, silkworm gut sutures, one pair of scissors, one dozen thoroughly aseptic sponges, bichloride gauze, a yard of half-inch tape, a tracheotomy-tube (Fig. 28).

Fig. 28.

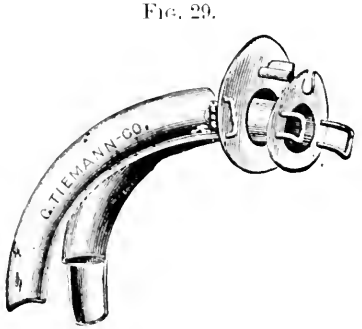


Tracheotomy-tube.

What is the best kind of tracheotomy-tube to use? Like most instruments, the tracheotomy-tube has been varied and modified considerably. All tubes have certain things in common—viz. an outer and inner tube, and a neck-piece to which tapes are attached to hold the tube in position. The one most commonly in use is made of hard rubber. The objection to this tube is that it must be made considerably thicker than a silver one, so that with the same diameter the lumen of the vulcanite tube is smaller.

Another form is the bivalve. The blades of the outer canula are fixed to the collar, and come in contact with each other when the inner tube is removed. This is to allow the tube to be inserted easily into the trachea. The blades are separated from each other by the introduction of the inner tube. The facility with which this tube is introduced into the trachea is the advantage claimed for it.

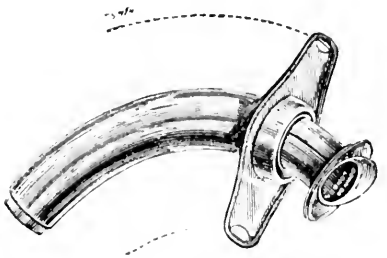
Fig. 29.



Bivalve Tracheotomy-tube

Other tubes in common use are Parker's, with a pilot, and Bryant's. Cuts of these tubes are appended. The tube which is the most convenient, and on the whole to be recommended, is Durham's lobster-tail

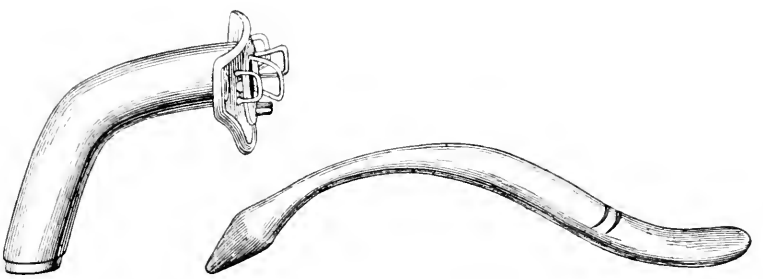
FIG. 30.



Bryant's Tube.

tube (Fig. 32). It is made of silver, and consists of an outer tube A,

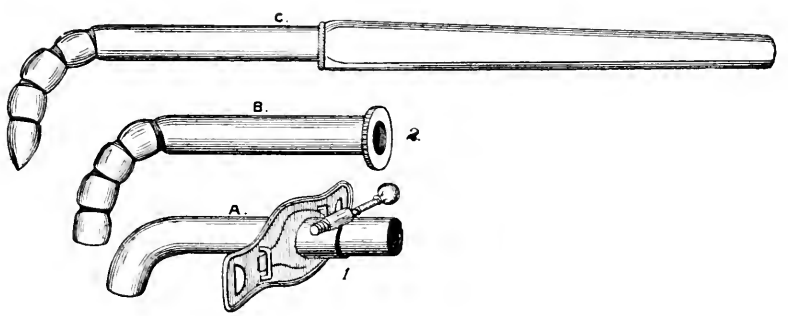
FIG. 31.



Parker's Tube. Pilot for same.

to which is attached the collar (1), which is capable of being fixed at any point along the outer tube by a screw (2). B is the inner tube,

FIG. 32.



Durham's Tube.

and C is the pilot. The advantages claimed for Durham's tube are that its shape is more in conformity with the direction of the external wound and that of the windpipe; it does not, like other tubes, irritate or abrade the anterior surface of the tracheal walls. As the position of the tube-end within the trachea depends upon the depth

of the trachea from the surface, this can be adjusted to each individual by shortening or lengthening the tube by means of the movable collar. The tubes are usually put up in sets of four.

Dr. James Bell of Montreal has devised a substitute for the tracheotomy-tube. This is known as Bell's hook. Appended is his own description of the instrument and the advantages he claims for it over the tracheotomy-tube:

"Being convinced that the tracheotomy-tube in diphtheritic cases was an evil (perhaps a necessary one), but nevertheless an evil and a source of many dangers, I endeavored to dispense with its use—first, by suturing the edges of the tracheal incision to the edges of the skin wound, then by wire specula, and finally with the clasps which I still use. The advantages claimed for these clasps are—(1) That they allow of greater facilities for the removal of tracheal and bronchial secretions through the wound, as well as greater breathing-space, as the lumen of the trachea is not lessened by the walls of the tube. (2) That where the membrane has not already extended down beyond the tracheal incision, direct contamination of the trachea and bronchi may be prevented by plugging the trachea above the wound with antiseptic tampons, which may be changed from time to time, and thus enable the surgeon to bring the operation into the sphere of what may be called modern surgery. While the tube is used this is practically an impossibility. (3) That the dangers arising from the use of a tube are avoided; and, finally, that there are no inherent disadvantages or dangers in the use of the clasps themselves. The dangers arising from the use of a tube I will simply enumerate; I am sure every operator is familiar with them. They are as follows: (1) The tube acts by its outer surface as a direct conductor of the irritating and poisonous (if not directly inoculable) discharges from above downward, and by filling the wound makes it impossible to cut off the communication above by means of tampons. (2) By lessening the lumen of the trachea, as well as by directly offering resistance to the expulsion of the secretions, it becomes a source of much trouble and anxiety to the surgeon, while the patient becomes exhausted by ineffectual efforts to clear the trachea and bronchi. This is especially noticeable on the second or third day after operation, when the secretions become dry and sticky and a tough, viscid plug forms at the end of the tube and on the walls of the trachea just beyond. (3) As it is impossible exactly to adapt a tube to the varying anatomical formations, its extremity always impinges on some part of the tracheal wall, often producing ulceration—sometimes, indeed, into the innominate vessels.

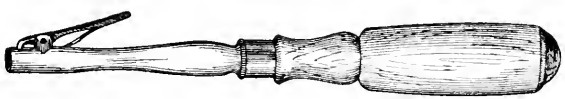
"Suturing the edges of the tracheal wound to the skin I found unsatisfactory. First of all, it is tedious; then it drags upon the trachea, and if swelling occurs the sutures tear or ulcerate through the

tracheal tissues; and finally, if the patient turns the head from side to side, the superficial tissues close the orifice. Wire speculæ, in addition to possessing many of the dangers of the tube, are difficult of fixation and unreliable.

"The clasp, which is of different widths (5 to 8 mm.) and from 3 to 5 cm. long, consists of a light band of spring steel doubled upon itself and bent to the shape of a quarter of a circle. At the fold the two bands are welded together, so as to allow of the free ends lying about a quarter of an inch apart. The edges of these free ends are bent in toward each other and serrated, while a slot runs longitudinally through the two portions, in which is a sliding rivet, which when pushed toward the points closes them. These serrated inturned edges are to grasp the edges of the tracheal incision, while the sliding rivet fastens them upon it. Some flat links are attached to the other end, and a removable handle enables the surgeon to hold the instrument in position, while the sliding rivet fastens it upon the tracheal tissues. The free edges are cut somewhat obliquely, so that when tied around the neck by tapes the tracheal wound edges may be drawn as nearly as possible transversely away from each other. With a clasp on each edge of the incision a tampon in the upper segment of the trachea or lower portion of the larynx, the secretions come readily into the wound, and may be removed by a glass tube with suction-bulb (like a medicine-dropper) or by a soft swab of cotton wool or sponge, while the wound remains open no matter what position the patient assumes."

Fig. 33.

Fig. 34.



All the instruments, sutures, and ligatures should be boiled in clean water for at least twenty minutes before the operation. They are then removed and placed in a shallow dish containing solution of carbolic acid (1 : 40). The sutures and ligatures, previously cut into the required lengths, are placed in separate bowls containing a solution of bichloride (1 : 3000). The site of operation should first be washed thoroughly with soap and water, and then wiped over with bichloride solution (1 : 2000).

The operator and his assistants should themselves observe the strictest cleanliness (asepsis).

The anæsthetic should be chloroform in preference to ether, as the latter is apt to augment the dyspnœa by increasing bronchial secretion. The anæsthetic must be administered with great care, and its effect

closely watched: profound narcosis should not be produced or the cyanotic condition of the patient may be aggravated; moreover, there is greater danger of suffocation from the passage of blood into the windpipe if the patient is deeply narcotized. It is better to operate during the first stage of anæsthesia.

The Operation.—The patient is placed before a good light, on the back, with a large round pillow under the shoulders, so as to allow the head to be somewhat depressed, thus putting the structures of the neck on the stretch and bringing the trachea near the surface. The operator stands on the right side of the patient, his assistant on the left. With the thumb and second finger of the left hand the operator fixes the larynx, and with the index finger of the same hand the cricoid cartilage is located. An incision is made from this point downward *in the middle line* to one inch above the episternal notch. The superficial and deep fasciæ are divided upon a director *from below upward*. The deeper structures are now more thoroughly exposed by retracting the edges of the incision with blunt hooks. The isthmus of the thyroid gland is now seen lying upon the trachea. The trachea may be opened at one of three points—(1) above, (2) below, (3) behind the isthmus of the thyroid. The opening should be made below the isthmus, as a better opportunity is afforded to remove any membrane from the deeper part of the trachea than if the opening were made higher up.

The trachea is now brought nearer to the surface with a sharp hook, the isthmus being drawn upward with a blunt hook. All bleeding points should be secured at each step of the operation, especially before opening the windpipe. The operator then passes the first finger of his left hand through the wound down upon the trachea, and guides the knife along that finger to the trachea, which he incises *from below upward*, dividing three or four rings. The inrush of air signifies that the trachea has been opened. The edges of the tracheal wound are held apart with blunt hooks, and any membrane found in the windpipe is removed with the small curved tracheal forceps. Any hæmorrhage which was present before the opening of the trachea generally ceases when air is admitted through the tracheal wound; but if not, the bleeding points should be secured and ligated with catgut.

The bleeding having been arrested and all the membrane possible removed, the tracheotomy-tube is introduced. Previous to the operation the tapes should be fitted and the tube thrust through the centre of three layers of sublimated gauze ($2 \times 1\frac{1}{2}$ inches). The edges of the wound above and below the tube may be brought together with silkworm-gut sutures. The tapes should be arranged to tie at one side of the neck, rather than directly behind.

Sometimes one is called upon to perform rapid tracheotomy. In such a case the operation differs but slightly from the one just

described. The operator makes an incision directly down upon the trachea, instead of dissecting down to it; then, with the index finger of the left hand upon the trachea to locate it, he cuts through the tracheal rings in the manner already described. The tube is then guided into the tracheal wound by the index finger of the left hand, which has been kept in the wound close down upon the trachea. The treatment of the wound and the arrangement of the tube are the same.

The subsequent care of the patient is of the greatest importance. A steam-kettle should be kept in operation in the room, so as to maintain a uniform temperature and keep the air well saturated with moisture. The tube must be carefully attended to. The inner one is removed every half hour and thoroughly cleansed by placing it in boiling water. A camel's-hair brush of moderate size or a feather is used to free the outer tube of any adherent secretion or fragments of membrane. After twenty-four hours the outer tube may be removed, thoroughly cleansed, and returned. The time when the tube may be finally dispensed with varies; in the majority of cases it may be taken out at the end of eight days.

After tracheotomy the patient is fed in the same way as after intubation, except that there is no need of altering the position of the patient when feeding, as there is usually little or no difficulty in swallowing.

During convalescence the patient requires continuous careful nursing. One important feature which is nearly always present is the tendency to syncopal attacks. This may be avoided in great measure by not permitting the patient to rise when being fed, and by keeping him in the recumbent position as much as possible. All sources of excitement should be avoided; relatives and visitors should be excluded from the room, and exciting conversation and news prohibited. In fact, absolute quiet should be maintained as far as possible.

Complications.—*Diphtheritic Paralysis.*—The sequelæ most commonly observed are of nervous origin (paralyses), caused by the absorption of toxic albumin. The commonest form of paralysis is that of the soft palate: the voice becomes harsh and nasal, and fluid regurgitates through the nostrils. Next in frequency comes paralysis of the ciliary and ocular muscles. When the ciliary muscles are involved, we find asthenopic symptoms, mydriasis, or loss of accommodation without mydriasis. When the oculo-motor muscles are affected, there is strabismus, which brings about diplopia and vertigo.

Next in frequency is paralysis of the muscles of the lower extremity. This is usually preceded by a feeling of coldness, numbness, tingling, or pain. There may be anæsthesia, and associated with this analgesia. Ataxic symptoms may develop in severe cases.

The upper extremities may be similarly attacked, or one set of muscles may alone be affected. The muscles of the pharynx and larynx may sometimes be attacked, as evidenced by the difficulty in swallowing and the tendency of food to find its way into the larynx when the pharynx is affected, and by the weakness and altered character of the voice when the laryngeal muscles (intrinsic) are affected.

The pathological nature of these lesions is peripheral neuritis.

In diphtheritic paralysis strychnine has been very warmly recommended by some, and as strongly denounced by others. It is given by the mouth or by hypodermic injection. In children of six to twelve years of age paralysis of the soft palate has been successfully treated by hypodermic injections into the neck of from $\frac{1}{30}$ to $\frac{1}{20}$ of a grain two or three times daily. Improvement has been noticed after the first injection, and in no case did the treatment last more than a week. The weight of opinion, however, seems to be rather against the general use of strychnine in diphtheria. If given at all, the dose should be moderate: for an adult, $\frac{1}{20}$ gr. three times daily; for a child of six, $\frac{1}{100}$ gr.; for children under five it had better not be used at all. Gentle friction or massage over the affected region is preferable in the case of infants and children, as they are generally frightened by electrical treatment. Electricity is very useful in furthering an improvement in paresis or paralysis of any set of muscles. The current should be very slowly interrupted. The negative pole is placed over or as near as possible to the affected muscles. The positive pole is placed at the back of the neck when the paralysis involves the muscles of the upper part of the body, and over the lumbar region when the muscles of the lower part of the body are implicated. As a general rule, the practitioner should remember that the strength of the current which is to be employed should be that which causes the most contraction with the least possible pain.

When electricity is used in paralysis of the ciliary or oculo-motor muscles, the strength of the current should not be greater than from 5 to 7 milliampères, and the first application should not be longer than two minutes. The time may be gradually lengthened to five minutes. In these affections the positive pole is placed over the temple, and the negative pole (a small round sponge being used as the electrode) is placed gently on the closed lid of the affected eye. The paresis or paralysis of the circular fibres of the iris (mydriasis) and of the ciliary muscle may be somewhat helped by instilling night and morning 1 drop of a solution of eserine of the strength of 2 grains to the ounce.

Diphtheritic Conjunctivitis is a condition which falls more correctly under the articles on Diseases of the Eye. (See Volume III.)

Cutaneous Diphtheria is an unusual form of the disease. There must have been abrasion of the affected part through which the diph-

theritic bacillus found entrance. The commonest site is the skin of the upper lip, near the nares. This part is liable to become irritated and excoriated by the acrid discharges from the nose in nasal diphtheria. Pseudo-membrane may also be found about the anus, vulva, vagina, prepuce, and glans penis. The diphtheritic process may attack open wounds, and is particularly disastrous in its affects when it invades traumatisms in the parturient canal of recently-delivered women. It then produces the most virulent puerperal septicæmia, and is usually rapidly fatal.

Wherever deposit occurs in cutaneous diphtheria the membrane is seen as a white, buff, grayish, or black layer of varying thickness, more or less adherent; the surrounding area is usually much reddened. Its extension is preceded by the formation of vesicles.

This form of diphtheria is treated by removing as much of the membrane as possible with a pair of forceps, and then thoroughly irrigating the part with sublimate solution (1 : 2000). The excoriated surface is then dusted with iodoform, boro-iodoform, aristol, or boro-aristol, and dressed with sublimate gauze, the dressing being kept in place by a well-applied bandage.

Prophylactic Measures.

When diphtheria is epidemic are there any precautions which can be adopted to diminish the risk of infection? Under such circumstances the specific bacillus, as well as the pseudo-bacillus, is undoubtedly widely distributed, and is inhaled by a great many people, and very little is needed to precipitate an attack. Many people suffer from pharyngitis during diphtheria epidemics, just as many suffer from diarrhœa, headache, and lassitude when typhoid fever is prevalent. When one member of a family is attacked with diphtheria he should be isolated at once, and parents should be warned of the danger of petting, fondling, and kissing the child and inhaling the infected breath. As many of the family should be sent away as possible, particularly the children. If this cannot be done, a careful inspection of the mouth and throat of every one in the house should be made daily. Chlorate-of-potassium gargles and tablets should be used freely to keep the secretions of mouth and throat healthy. If any one is suffering from nasal catarrh, a mild astringent disinfectant douche or spray should be used several times daily:

℞. Listerine,		f℥j;
Acid. boric.,		gr. vj;
Glycerini,		f℥j;
Aquæ,	q. s.	f℥j.

When diphtheria is epidemic prompt treatment should be given to nasal catarrh, affections of the mouth, tonsils, ears and eyes, abrasions, sores, eruptions of the scalp—in fact, to all solutions of continuity which might afford entrance to the diphtheritic germ. During an epidemic is not a good time to resect enlarged tonsils or to do any surgical operation, and certainly no surgical operation should be attempted if there is diphtheria in the house. Pregnant women require special care before, during, and after confinement. The sanitary condition of the house should be looked into; physician and nurse must see that they do not carry infection on their persons, clothing, or instruments. The utensils employed in the confinement-room should be new; vaginal examinations and douches should be avoided if possible; sublimate jute should be used exclusively for washing and cleansing the vulva, and great care taken in applying and changing the antiseptic vulvar pad. The breasts should be protected from cracks and abrasions, as diphtheria sometimes attacks sore nipples, with disastrous results for both mother and child. Particular pains should be taken in washing the child's mouth, so as to prevent stomatitis and thrush. If a nursing infant contracts diphtheria, it must not be allowed to nurse, or the mother will probably be infected. There would be less risk for a nursing mother if she wore a good nipple-shield.

The physician must hold decided views respecting the infectiousness of diphtheria, for his opinion will often be asked in sanitary questions of local importance. It is a popular belief in many parts of the country that diphtheria may be contracted by inhaling the breath of an infected person, but that it cannot be carried. From what has been already said, it is evident that anything to which particles of diphtheritic membrane adhere may be the means by which infection is spread, and may retain that power for a length of time. Welch says that although the diphtheritic bacillus forms no spores, it is nevertheless one of the more resistant of the non-spore-forming class, and withstands for a long time drying and other influences which are injurious to the less resistant forms. Specific bacilli have been obtained in cultures made from diphtheritic membranes preserved dry in a piece of linen cloth for five months. The bacilli may live still longer in a moist state, and it is not improbable that the virus may retain its activity for a year or more in damp houses.

If people could only be made to realize these facts, they would be willing to isolate diphtheria as strictly as small-pox. Schools churches, theatres, hotels, public resorts, public conveyances, would be inspected and disinfected in times of epidemic. Strict isolation of patients would be insisted upon until the danger of infection is past; and such isolation would be made possible for the poor, for transients, and for those living in boarding-houses by the provision of suitable

hospitals for the sick and places of refuge for families while their rooms are being disinfected. It would be criminal for an infected person knowingly to use an ordinary cab, railway-car, or steamer, but at the same time suitable vehicles would be provided for the conveyance of such persons. There is no more interference with personal liberty in isolating a case of diphtheria or quarantining an infected family than in treating small-pox and yellow fever in a similar way. When the people are educated to the teachings of modern science they will realize the necessity of adopting stringent measures to limit the spread of infectious disease. Who are to be the educators, the apostles of light, if it is not the members of the medical profession? Each man in his own little circle, no matter how obscure or limited it may be, can be an educator, a civilizer.

In times of epidemic schools should be closed or a daily inspection of the scholars made by a competent officer. Particular care should be taken about re-admitting children who have just recovered from an attack of diphtheria. I have already pointed out how fallacious is the ordinary time-limit. The certificates which the children bring from their physicians, that they may return to school without risk to the other scholars, have no value whatever as a guarantee of safety. The physician cannot be supposed to have personal knowledge of the thoroughness with which disinfection of the house, clothing, and person of the child has been carried out, and probably has neither the requisite time nor skill to make a bacteriological examination in case of doubt. In the light of present knowledge I do not believe that a physician can conscientiously give a certificate, such as school boards generally exact, without the expenditure of much time and possibly a bacteriological examination. The only safe way is for school boards to insist in every case upon the applicant for re-admission bringing a certificate from the local health authorities that the requirements of the law have been fulfilled and that it is safe to return to school. School boards as well as health boards are servants of the people, and should act always for the best interests of the people. Both should co-operate heartily in dealing with an important question which is so closely bound up with the happiness and welfare of the community. Competent health officers should be appointed, not only to supervise isolation and disinfection, but also to make or obtain bacteriological examinations when required, inspect schools in time of epidemic, and grant certificates for the re-admission of convalescent scholars. In a word, the stamping out of a diphtheria epidemic is a matter of the gravest public import, affecting the interests of the whole community, and should be handled as such: private interests, feelings, rights, and prejudices must be subordinated to the public welfare.

In case of death from diphtheria the funeral should be private and arranged as speedily as possible.

(For the methods of disinfection of clothing and houses see the article on Disinfection in Volume I.)

ASTHMA, ACUTE AND CHRONIC BRONCHITIS, AND WHOOPING COUGH.

By JAMES T. WHITTAKER, M. D.

ASTHMA.

General Considerations.

Asthma is a paroxysmal dyspnœa caused by a peculiar catarrh, with spasm of the bronchi. The various lesions found by the pathologists in the earlier revelations of the dead-room and the disclosures made by physical diagnosis soon directed the causation of asthma to the organs found affected—thus, to the lungs by Bégin, to the heart by Broussais, to the brain and cord by Georgèt—until finally the very existence of the disease as an independent affection was denied altogether, as by Rostan, who regarded it as only a symptom of various affections.

The paroxysmal, if not periodic, occurrence and convulsive character of the attack had, however, from all time directed attention to the nervous system as the seat of the disease. Both Willis and Cullen, for instance, spoke of nervous asthma. But it was not until the appearance of the paper by Ramadge (1835) and the prize essays by Bergson and Lefèvre (1836) that asthma was really regarded as a neurosis of the respiratory organs—a view which seemed established by Romberg (1841), who based his conception of the disease, as a *spasmus bronchialis*, upon the discovery by Reiseissen (1808),[1] of muscular tissue in the finer bronchial tubes, and the contraction of these tubes under galvanization of the lungs by Williams (1840), and irritation of the vagus by Longet (1842).

The failure of both Budd and Rügenberg to produce contraction of the bronchi by irritation of the lungs and vagus led Wintrich (1854), who also failed, to propound the view that asthma depended upon spasmodic contraction of the diaphragm. For, he declares, the enlargement of the lungs in all directions is enough of itself to refute the idea of contraction of the bronchial tubes. The lungs ought to be smaller

[1] Reiseissen, F. D. R., graduated in Strasburg, 1803; thesis, "De pulmonis structura." The famous essay, *Ueber die Structur, die Verrichtungen und den Gebrauch der Lungen*, was written conjointly with Sömmering, and was awarded a prize by the Berlin Academy of Sciences, 1808.

in such cases. Less air is admitted, the diaphragm should ascend into the chest, the intercostal spaces become more marked; in fact, the diameters of the chest should be lessened in every direction. But the very reverse conditions prevail in asthma.

Bamberger, in 1870, brought to the support of this view a series of shrewd observations made at the bedside. He noticed during the attack the retraction of the lower zone of the chest, the board-like induration of the abdominal walls, and the almost absolute fixation of the lungs, so that the upper limit of liver-dulness did not vary a line in expiration, and there was no appreciable difference in the covering and uncovering of the heart by the lungs,—all of which declare positively for spasm of the diaphragm. As for spasm of the bronchial muscles under these conditions, it is, he declares, "improbable if not unimaginable."

At this juncture Biermer (1870) entered the list as the knight of the losing cause, which he succeeded in re-establishing more firmly than ever for a time. He fortified the physiological breach by appeal to the experiments of Paul Bert (1870), as subsequently verified by Gerlach (Ludwig) and Gillary (Donders), which demonstrated beyond dispute contraction of the finer bronchi under irritation of the lungs and vagus. Next he admitted the low level of the diaphragm, declares it in fact to be constant in this disease, but explains it as due not to tonic spasm, but simply to the distension of the lungs, which offers hindrance to its ascent.

There is such a thing as spasm of the diaphragm. Duchenne studied it in animals as produced by faradization of the phrenic nerve. It is marked by a brusque inspiration and a short expiration, with permanent dilatation of the lower thorax. Tonic spasm of the diaphragm is seen in tetanus, where it produces asphyxia, not asthma.

The distension of the lungs which prevents the ascent of the diaphragm in asthma is caused in turn by spasmodic contraction of the bronchial tubes. Very slight contraction of the bronchial tubes will markedly interfere with the escape of air from the lungs. A little thickening of the bronchial mucosa with accumulation of mucus produces the pronounced dyspnœa of capillary bronchitis. Hæmorrhage in the tubes leads to such great distension as to prevent collapse of the lung on opening the chest after death. True, the lung is not reduced in size in asthma. It is increased on account of its emphysematous state. But this is no argument against contraction of the bronchial tubes. Contraction of the bronchi would not reduce the size of the lungs. The whole lung must contract to have this effect. In asthma it is not a question of contraction of the lung, but of tubes inside the lung, which thus prevents the escape of air. For it is expiration rather than inspiration that is interfered with, hindered,

and prolonged. Four or five seconds of time are often consumed in expressing, with every strain, the air from the chest, while inspiration is effected in one or two seconds. There is no pause at all between the two.

Lebert, writing in 1873, is not willing to admit that all phenomena of asthma can be explained by contraction of the bronchial tubes. The dilatation of the air-cells, for instance, is not to be accounted for in this way. In capillary bronchitis the tubes are blocked, the obstruction is often profound, the dyspnœa may be terrible, yet there is no, or but slight, dilatation of the air-cells, and no, or but slight, immobility of the lower thorax. It is necessary to invoke the action of the diaphragm, as well as of other muscles of respiration besides those of the tubes, to properly explain an asthmatic paroxysm.

Weber in 1872 expressed the belief that other factors must coincide with the bronchial spasm to produce asthma. Chief among them is a sudden dilatation of the blood-vessels, with tumefaction and rapid exudation. Such a dilatation occurs in the experience of every one in acute nasal catarrh, often in hay fever, and leads to stenosis or actual occlusion. Riegel thinks that this view is supported by the experiments of Lovén, who demonstrated a reflex vascular turgescence in the domain of irritated sensitive nerves, and Störck supports this view by the demonstration with the laryngoscope of acute hyperæmia and tumefaction during the attack in the whole course of the trachea and bronchi as far as may be seen.

Whatever doubt still hung about the contraction of the bronchial tubes themselves would seem to have been finally dissipated by Lazarus (1891), who devised an ingenious apparatus wherewith he could, with the aid of curare and tracheotomy, experiment upon animals in life, and whereby he produced the characteristic dyspnœa of the disease by irritation of the vagus nerve.

Leyden in 1872 built a pier in the support of the bronchial-contraction theory, or at least contributed a solid block to differential diagnosis, in the discovery in the sputum of certain crystals, angular, elongated octahedrals, which might be supposed to be the active irritative cause of the attack. These crystals are found in grayish masses in the sputum, varying greatly in size, colorless or of a bluish tint, surrounded by masses of epithelium, and imbedded often in certain peculiar structures known as spirals. Some of them are distinctly visible with the simplest lenses, but they vary so much in size as to be manifest, some of them, only with higher powers, as with a Hartnack No. 8. These crystals are insoluble in cold water, alcohol, ether, and chloroform, but are easily soluble in alkalies, mineral acids, warm water, ammonia, and acetic acid: which plainly allies them to mucine, a form of which Salkowski declares them to be. They are identical with the

crystals discovered by Charcot in semen, which Klemperer has shown to be a phosphate of diaethylendiamin, and by Neumann in the blood and marrow of cases of leukæmia. They are most abundant during and after the attack of asthma. Friedreich and Zenker found them also in the fibrinous plugs of bronchitis, and Bizzozero and Von Jaksch saw them in bronchial catarrh without asthma. They have been observed also as curiosities in the fæces in cases of anchylostomiasis. Most interesting is the fact that Lewy found them in nasal polypi, but more especially in the pale grayish gelatinous masses in patients not affected with asthma. He could not find them in the hyperplastic tissues or tumors encountered in certain cases of asthma.

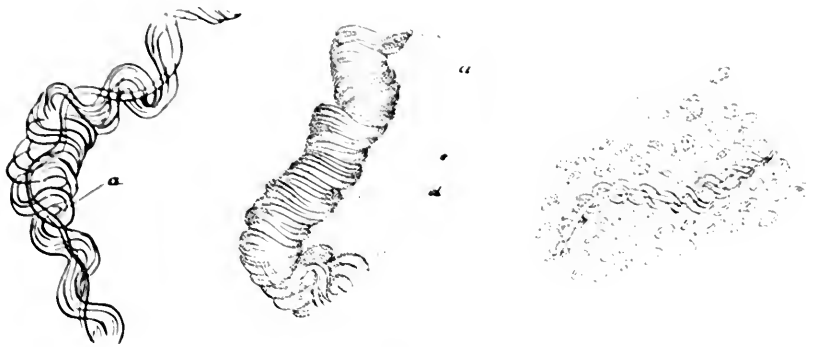
FIG. 35.

Charcot's Asthma Crystals, after Riegel.

Leyden in the same year made the discovery in the sputum of asthmatic patients of the certain peculiar spiral structures alluded to above, which Curschmann later more fully described and advanced as characteristic of bronchial asthma. These spirals, the so-called Curschmann spirals, exist also in the grayish masses found in the sputum, often in connection, as stated, with the Charcot-Leyden crystals in most frequent abundance at the beginning of an attack and in sharp, acute cases. They may be recognized even with the naked eye in their largest size, but are better defined with the microscope of low power as elongated spiral fibres grouped about a series of central and more open fibres, which present the appearance of a central canal. They exhibit, according to Vierordt, the finest forms of bronchial products, and hence correspond probably to catarrh of the smallest bronchial tubes (bronchiolitis exudativa). They are not exclusively present in asthma, but have been remarked also in croupous pneumonia and

tuberculosis. These spirals also represent forms of inspissated mucus. They are, like the crystals, products, not causes, of a peculiar bronchial catarrh.

Fig. 36. Fig. 37. Fig. 38.



Curschmann's spirals (after Curschmann).

It has been remarked that the spirals exist in greatest abundance at the beginning of the attack, when the crystals may be entirely absent to present themselves in greater abundance later in the history of the disease. Indeed, crystals have been made to develop directly from or in the spirals in sputum protected for several days from evaporation. From the fact that both crystals and spirals have been found in other affections, they cannot be regarded as pathognomonic evidence of asthma, but there is no doubt of the supreme value of these structures in differential diagnosis; for in any case of dyspnœa the existence of either crystals or spirals in the sputum speaks emphatically for bronchial asthma. Revealed as they are by a glance under the microscope, search for them in a doubtful case should not be neglected.

Further corroborative evidence is furnished by cell-elements in the sputum. Müller demonstrated in the sputum of asthma numerous large lymphoid bodies with pale-yellow pigment-granules, which showed affinity or avidity for eosin, an acid aniline dye—the eosinophile cells of Ehrlich. Lewy found these same cells in nasal polypi, especially in the gelatinous masses with but little gland-structure.

Asthma has been reduced to two varieties—idiopathic and symptomatic, or primary and secondary. But it is doubtful if there be such a thing as idiopathic, essential asthma. Every year narrows more and more the number of idiopathic cases, with the discovery of some cause, immediate or remote, to account for the attack of the disease. These causes may be grossly divided into mechanical, chemical, and reflex, whereby many cases may fall under more than one head. Thus, among the mechanical causes may be cited goitre, the so-called thymic asthma, aneurism, trauma, foreign bodies, dusts (pollen, etc., grinder's asthma), rickets, disease of the vertebræ (Pott's disease), disease of the heart

(cardiac asthma), and certain diseases of the lungs, more especially bronchitis and tuberculosis. Under the chemical or toxic causes are renal, gastric, saturnine, mercurial, and malarial asthma and the asthma produced by odors, also cases of arthritic and tuberculous asthma. Under the reflex causes are gastric, cardiac, sexual (especially uterine), intestinal (verminous), traumatic, and nasal asthmas. Finally, a small category of cases is to be attributed to psychic causes or ideas—hysterical asthma. Most of these cases, it is plain to see, are cases of dyspnœa rather than asthma.

The exact method by which asthma is produced by any of these causes remains as yet unknown. It is assumed that there is some irritation in the centre, in the course of, or at the periphery of, the vagus, which excites the muscular tissue to contraction, so that the existence of an idiopathic form in our day implies a concealed cause. It is better to assume a cryptogenic than an idiopathic origin in all cases, if only because one stimulates, the other stifles, inquiry. While, therefore, it may be doubted whether there is such a thing as an asthma which is a pure neurosis—*i. e.* independent of an outside cause—it may be admitted that the sensitiveness of the nervous system differs in different people, and that certain individuals are more liable than others to attacks of asthma from the same cause. In other words, asthma implies unstable nerve-cells of easy explosion, and takes its place in nosology by the side of epilepsy, insanity, migraine, etc., with which indeed it sometimes alternates. It will be most in accord with modern medicine to look for the cause of the hyperæsthesia of the vagus in irritations caused by micro-organisms—diplococci, for instance, tubercle bacilli, etc. or ptomaïnes,—rather than in "heredity."

A few other etiological factors remain to be considered. First, heredity, which plays a very insignificant rôle in the production of asthma. Riegel observed of cases in which asthma was transmitted from father to children that the disease occurred in these cases at the same age as in the parents, and disappeared spontaneously at the same age as in the parent. It has been known to skip a generation, or, better put, to reappear in grandchildren. Age plays a more important rôle, in that, according to the statistics of Salter, of 153 cases one-fourth were under the age of ten, and four-fifths under forty years. Sex, social position, and vocation have less to do with the production of asthma. The disease occurs more frequently in males and rather more frequently in the luxurious upper class, but it is by no means rare among the poor. Teachers, clergymen, attorneys, people who lead sedentary lives, are rather more frequently affected.

Since Cullen made the first observation of the development of asthma in an apothecary's wife whenever ipecac was powdered in the shop, similar cases have been reported by most observers. There is, however,

an endless variety of materials which may evoke asthma in a patient affected with the asthmatic tendency. Thus the smell of a sulphur match, pitch, smoke, hay, tobacco, the rose, lily, and other flowers, coffee, and the odors of the kitchen, odors of certain animals—cats, rats, dogs, horses, rabbits, guinea-pigs, chickens; the odors of wild animals, as in menageries,—precipitate attacks. Literature is full of curiosities in this regard. The proprietor of an equestrian establishment suffered from asthma continuously until he retired from business, when the disease ceased, to return, however, whenever he returned to his horses. Fagge speaks of the case of a lady who was affected whenever she came into a room in which was a cat, no matter where the animal was hidden. Ramadge tells the story of an employé in the East India Company who had to give up a lucrative appointment because the smell of tea developed an attack of asthma. Austin Flint was unable to sleep on a feather pillow. In one case the odor of roses brought on an attack, and so sensitive was this lady as to suffer a seizure on one occasion, though the rose which was held before her was artificial.

The frequency with which an explosion of asthma has occurred in consequence of real odors should have sooner led to the investigation of the nasal cavity for sensitive areas. Voltolini long ago made the observation that asthma may be produced by a polypus in the nose. In one of his cases removal of the polypus relieved the asthma, which returned with the recurrence of the growth, to disappear again with its extirpation. These observations have been abundantly confirmed by observers, many in our own land—first by Hænisch, and more lately by Hack, Roe, Harrison Allen, and Bosworth; so that at the present time the tendency is to exaggerate the importance of the naso-pharyngeal genesis of asthma or to consider that the disease results exclusively from this cause. According to Schmiegelow, asthma has a nasal origin in 30 per cent. of cases—*i. e.* polypus 22, rhinitis 8.

Errors, more especially excesses, in diet frequently excite an explosion of asthma. Attacks limited to certain days of the week can generally be traced to this cause. The peptic asthma of the old writers were reflected indigestions, better explained in our day by gastric distensions and interferences with the circulation.

Colds account for the many cases associated with bronchitis. These are the cases in which attacks occur after every exposure. It is needless to say that the cold was caught in the majority of cases in the crowded, badly-ventilated room before the exposure of the return journey. Regarding the relations of tuberculosis and asthma, there is a note later on.

Locality is a factor of etiology which cannot be overlooked. It has long been remarked—and the point was especially emphasized by Salter—that some patients who live in the country get absolute exemp-

tion from attacks during a stay in the city. The immunity seems to be more assured or absolute as the air of the city is vitiated by soot, and more especially by fog. London excels in this regard. Thus patients have come from the country to consult physicians in London, waiting for the development of an attack which never occurred, and have returned home in the belief that the disease was cured, to be attacked on the night of their return. And many patients must make a regular habit of visiting the cities at stated intervals or must make a permanent change of residence.

To sum up with regard to the etiology of asthma, it may be stated that the disease requires three factors: first, bronchial spasm; second, bronchial catarrh, which, however, may be entirely absent in an individual case; third, hyperæsthesia of the vagus nerve, which must always be present, and which constitutes what is known as the asthmatic tendency. In such a case an irritation anywhere at the periphery of a sensitive nerve may be reflected to the vagus to produce bronchial spasm. A not infrequent source of irritation is the uppermost portion of the respiratory tract—to wit, the nasal mucous membrane—and it is the middle and lowest portion of the nasal fossa, that about the turbinated bones, that the relation of this irritation is most frequently observed. Thus, the removal of polypi from the inferior meatus has cured a case of asthma, while other and even numerous polypi still remained in the upper nasal passages. Hyperplastic mucous tissue, adenoid tissue, hyperæsthetic areas, bony occlusions, irritations, or stenoses of any kind or cause in this portion of the respiratory tract, are the most prone to produce asthma. It is undeniably true that these conditions may exist without the production of asthma. It is equally true that some one of these conditions can be found in a large number of cases. Irritations about the larynx, especially of the interarytenoid folds, are much less frequent causes. Glasgow made an interesting confirmatory observation of such cause by the accidental application of a concentrated solution of carbolic acid to the larynx for some local affection, when the asthma from which the individual had suffered severely for years disappeared, never to return.

True asthma—that is, the pure nervous asthma, by which is meant asthma without discoverable cause—is, as a rule, sufficiently easily recognized. The age of the individual, the time of its occurrence—*i. e.* during the night—the suddenness of its onset, the intensity of the dyspnœa, above all things the difficult expiration, the sibilant and sonorous ronchi, the great anxiety, the struggle, the "*Lufthunger*," with the gradual cessation to complete relief and the free interval, unmistakably stamp the disease.

The diseases which most closely simulate asthma are—first, affections of the larynx, spasm of the larynx, false membrane, and œdema of the

larynx, to which may be added tracheal stenosis. But in all these cases the difficulty is with inspiration, not expiration. Inspiration is a long, powerful stridulous struggle; expiration follows easily. There are no wheezing sounds in the chest. The condition is often recognized with the laryngoscope. The onset of laryngeal affection is always more gradual; artificial relief is never so abrupt. Spasmodic contraction of the adductors or paralysis of the abductors shows the same inspiratory dyspnœa. Laryngismus stridulus is closely allied to asthma. It is also a neurosis with little or no associated catarrh. Paralysis of the posterior crico-arytenoid muscles is easily recognized with the laryngoscope. The vocal cords are found approximated or separated by only a narrow chink. Œdema of the larynx occurs in consequence of acute laryngitis, or of disease of the kidneys or lungs. Tracheal stenoses, unless due to foreign bodies, where the history is plain, are caused by neoplasms, syphilitic or carcinomatous, or by aneurisms or by goitre—conditions readily recognized by simple inspection or by evidences elsewhere in the body.

Certain diseases of the lungs, more especially bronchitis and emphysema, resemble asthma in the fact that the expiratory dyspnœa predominates. It is often difficult to distinguish between asthma and emphysema because of their frequent coexistence. Asthma produces emphysema, yet either may exist without the other. The emphysematous patient has the configuration and habitus of the chronic asthmatic. The dyspnœa is more or less continuous; it is aggravated by exercise, excitement, emotions. Its exacerbations, which simulate asthma, attack the patient more therefore when he is awake. True asthma occurs for the most part in sleep. The wheezing sounds are not so abundant in pure emphysema as in pure asthma. Crystals and spirals, eosinophile cells, rare in emphysema, occur as a rule in asthma. Intermission is the rule of the dyspnœa in asthma, remission in emphysema.

Bronchitis distinguishes itself by its more gradual, never sudden, onset—by its more abundant cough and expectoration, which, at first mucous, may become purulent—a change which never shows itself in asthma. In bronchitis the wheezing sounds, although sometimes universal, are confined more especially to the posterior inferior lobes of the lungs. They are never so intense as in asthma. There is more or less fever—absent in asthma—in acute diffuse bronchitis, which form alone resembles asthma.

Dyspnœa from heart disease closely simulates asthma at times. Here too, however, the dyspnœa is more strictly dependent upon exercise or cardiac activity. In cardiac dyspnœa there is evidence of heart disease. There are valvular murmurs, accentuations, hypertrophies, irregularities in rhythm, and general dropsies. The disease does not set in suddenly or subside suddenly. There is not

the same wheezing in the chest. The dyspnœa may become profound in cardiac disease, more especially in the later stages, in consequence of œdema of the lungs. Œdema of the lungs does not, however, show the same degree or the same kind of dyspnœa. Respiration in it is more shallow and superficial. It is not so much a question of obstruction as of infiltration. The expectoration is more profuse, watery, and is often tinged with blood.

Spasm of the diaphragm shows quite a different picture. There is a sudden abrupt inspiration, often attended with hiccough and forcible fixation for a few seconds, then a quick, violent expulsive effort. Spasm of the diaphragm is best seen in tetanus.

Intercostal neuralgia, which restricts the action of the respiratory muscles, may be distinguished by its painful points and by its pain in general. There is no wheezing cough, no expectoration. Embolism of some of the branches of the pulmonary artery sometimes resembles asthma. Embolus is found in connection with heart disease. Respiration becomes suddenly irregular. There are intense anxiety, often expectoration of blood, profound dyspnœa, which differs from asthma in affecting both inspiration and expiration, marked prostration, and not infrequently sudden death. Often there is evidence of embolus elsewhere.

Asthma having been recognized and differentiated from dyspnœa caused by affections of the larynx, lungs, or heart, the question presents itself: What is the form of asthma, primary or secondary? This question is by no means easily answered; it involves often an examination of all the organs of the body, especially of the avenues of respiration, disease or irritation of which might by reflex process excite the vagus nerve; and it is only when such disease is excluded that we are justified in considering the case as primary asthma.

Treatment.

The treatment of asthma resolves itself into two problems: to cure or cut short the attack and to prevent its recurrence; in other words, to treat the paroxysms, and to treat the patient in the intervals between the paroxysms.

The patient should be placed first in a comfortable position, which, indeed, he himself usually seeks. There should be allowed the same latitude of disposition of the body in the paroxysm of asthma as in the pains of parturition. Tight clothing should be loosened, free ventilation secured, officious ministrations avoided. To sit up in bed with the elbows upon the knees elevates the shoulders from the chest and gives additional points of support to the extraordinary muscles of respiration. This posture is usually taken at once. Many patients get this relief sitting in a chair with the elbows supported upon its arms;

others kneel with the elbows upon the chair or side of the bed, or seize the framework of the bed, or stand with the hands grasping the mantel or the elevated sash of the window. Individuals have found some comfort by supporting the shoulders on short crutches by the side of a chair, and various apparatus has been devised, arm-chairs with special supports or head-bands and shoulder-supports swung from the ceiling—different postures for different individuals.

Should the attack be clearly due to indigestion, stomachic or intestinal, the quickest means of relief is by an emetic or an enema. A cardiac or a renal asthma is often quickest relieved by a hot bath. Offensive odors, animals, flowers, feathers, drugs, should be removed at once, or the patient may be removed from their vicinity. The mere lighting up of a dark room at night sufficed to relieve Trousseau.

As a sort of routine practice, inhalations are used by the patient himself at the onset of the signs, and the treatment may begin with mention of them.

The fumes of saltpetre have been used for fifty years, and probably no single remedy has so wide a range of utility. It is, as Salter remarked, always a matter of surprise to learn that an individual has not tried this drug. Often it fails from improper use. The patient may make the solution himself, or buy it prepared, alone (*chartæ potassii nitratis*) or with other drugs. Ordinary blotting-paper, not too thin or too thick, is dipped in a warm saturated solution of saltpetre, dried, cut in squares or strips, and ignited, the patient breathing the fumes as they arise. The room should be small—a closet with a partly-opened door, a seat under an umbrella, or a tent of bed-clothes over a chair—to substitute the curtains of the old four-posters, which we now rarely see. It may be inhaled in any desired strength from under a funnel. If it is to act at all, it acts quickly, usually exciting some cough at first; breathing becoming easier in a few minutes. Patients use it also as a preventive, inhaling the fumes for a few minutes before retiring or just after retiring, or they leave the strips in easy reach to be ignited with the first manifestation of symptoms. There are patients who rather prefer not to go to bed at all than to have to dispense with the fumes of nitre. It should be used at the very beginning of the attack. Sometimes it gives but partial relief; sometimes it succeeds at first and fails later; sometimes it fails utterly. Nitrate of potassium parts with oxygen readily, and it is believed that its virtue in asthma is due to the nitrite which is left. The older practitioners use it also freely internally in doses of 20 grains, with 20 or 30 grains of the carbonate of potassium, in a tumbler of water three or four times a day.

Stramonium is a still older remedy, having been introduced from India in 1802. The stramonium most in use in our country is the

leaves of the common Jamestown weed dried and ignited, or preferably rolled in the form of a cigarette. Stramonium may reach cases in which nitre fails. The converse is more frequently true. Stramonium is a more dangerous remedy. The danger is obviated by a cessation with the first confusion of sight or intellect. Both nitre and stramonium sometimes fail completely. They are more likely to succeed in toxic or purely bronchial cases, and fail in every way in nasal or naso-pharyngeal cases.

Coniine, hyoscyamine, and hyoscine are remedies which have been used as substitutes for stramonium, but they succeed only in the most exceptional cases and in the face of greater dangers. More may be claimed for atropine. Belladonna was the favored remedy of Trousseau, who recommended that it be used for a long time with occasional intermissions. Lenhossék, Harley, Salter, each advocate it strongly. Its best effects are obtained when used in a grain-to-the-ounce solution, beginning with from 2 to 5 drops, and pushed gradually to tolerance. It should be given at bed-time, to anticipate the onset of the disease in the early morning.

The remedy which has the most sovereign control over the greatest number of cases is morphine subcutaneously. Morphine rarely fails to abort an attack of asthma. It should be given in doses of from $\frac{1}{8}$ to $\frac{1}{4}$ grain. Some of its evils may be counteracted by admixture with $\frac{1}{100}$ or $\frac{1}{120}$ grain of atropine. Morphine would be used universally were it not for its unpleasant after-effects. It nauseates some patients, and disturbs the digestion of nearly all patients. It produces discomfort for the whole of the following day. Most patients prefer rather to suffer an attack of asthma during the night than to endure the discomforts of morphine and disqualification for work for the whole of the following day. Then, too, morphine has the disadvantage that it soon begets tolerance. The dose must be gradually increased. There are authors who maintain that it is better to suffer the evils of morphine than the damage which protracted paroxysms of asthma produce. There are individuals who learn to use the remedy only in the worst attacks, and thus are not obliged to increase the dose. Stevenson in five years never increased the initial dose over $\frac{1}{6}$ grain, with uniform success. It is not good practice to resort regularly to morphine: morphine is to be used as a *dernier ressort*.

Next to morphine—in the estimation of many practitioners, far above it—stands chloral, which often, indeed, "acts like a charm." Chloral is given in large doses, 15 to 40 grains largely diluted, at once, rather than in small doses frequently repeated. It acts quickly, relaxes the spasm, and gives the indescribable relief of a full breath in the course of five or ten minutes. No remedy has received higher

praise; no remedy is more satisfactory in most cases; no remedy fails so utterly in many others, for when it fails it aggravates the case. It acts best in those cases which seem to be more strictly idiopathic. It acts worst in heart disease, where it is even dangerous. It is certainly not good practice to resort indiscriminately to chloral. The drug does not deserve the praise lavished upon it a decade ago. It falls short if only because it fails to address the cause. It leaves the nervous system weaker than before. Yet both morphine and chloral are indispensable in certain cases. The practitioner must decide for the individual case.

It is the experience of the writer that his most intelligent patients refrain from or decline the use of either chloral or morphine. If they can get relief from no other agent, they will, as a rule, endure the ills they have, convinced of relief by nature in time.

To most patients relief, sometimes absolute, more frequently partial, but relief enough for sleep, is furnished by the use of some one of the antipyretics—antipyrine, antifebrin, phenacetin, or quinine. For an adult there is usually required, at a dose, of antipyrine 10 grains, of antifebrin 5 grains, of phenacetin 15 grains, of quinine 10 grains; and one such dose at bed-time or at the beginning of the attack will, as stated, usually suffice at least to modify the attack.

Chloroform acts more quickly than chloral, and there is no case that will resist inhalations of the drug. Unfortunately, the good effects of chloroform do not persist. The symptoms return after the cessation of its use. Sometimes, however, a few whiffs of chloroform permanently cut short an attack. It is astonishing with what impunity chloroform may be inhaled in asthma when administered by skilful hands. It does not seem to have the same contraindications as in other affections. Chloroform can be used in asthma with the same impunity as in parturition, probably from the same cause. Chloroform is dangerous when patients use it themselves, and fatal accidents have often occurred in this way. Where patients are compelled to use it themselves, four or five drops should be let fall upon and inhaled from a handkerchief. Other anæsthetics of equal or nearly equal value are ether, iodide and bromide of ethyl, the nitrite of amyl, and pyridin. All these remedies are to be inhaled in the same way from a handkerchief, except that pyridin is better administered by being poured—a dozen drops—upon a hot plate and inhaled in a small room or closet. The author has read and heard of many striking and marvellous accounts of the value of pyridin, but has never seen it succeed in a single case. It may be said of all these succedanea that they are of value only in the milder cases, and that they will fail entirely in the majority of cases. And it may be said of chloroform that, while it may be inhaled in small quantities without danger, it becomes so dangerous in large quantities, often in sufficient

quantity, and of such temporary value in all quantities, as practically to exclude its use.

In the case of fatty heart, where there is decided contraindication to chloral, paraldehyde has been used as a substitute, best administered with the tincture of orange-peel.

The fumes of sulphur and of arsenic have been used from the days of Fracastorius, and may be tried in desperation after all other remedies have failed. Of the powerful modern remedies used to abort an attack, may be mentioned nitro-glycerin subcutaneously, 1 to 3 drops in a syringeful of water; strychnine, $\frac{1}{30}$ grain; atropine, $\frac{1}{150}$ grain, both subcutaneously. Occasional cases yield to exceptional drugs.

Tobacco is a drug that has no superior in persons who are not accustomed to its use. The profound nausea that is caused by the smoking of tobacco stops asthma like the wave of a magician's wand; and this may be said of any agent that has the same effect, as of antimony and lobelia. Nausea is the enemy of asthma as of any other spasm. Unfortunately, the remedy cannot be used by most males because of tolerance, and by most other people because of the extreme suffering which intense nausea means. There are many individuals, however, who have learned to smoke to protect themselves against asthma, who have remained free from the attacks so long as they have used tobacco. But it is true of the majority of cases that the asthma will assert itself so soon as tolerance is established. Most patients prefer the distress of severe asthma to intense nausea, and are driven to the use of emetics—ipecac by preference—only because experience has taught them the futility of everything else.

Of all the agents which suddenly control asthma, none is so effective as a profound mental emotion. Whether pleasurable or painful, the effect is the same; but the emotion must be intense. It must be in the nature of a shock. A sudden surprise, excessive joy, grief, fright, a cry of fire, may cut short an attack at once. Knight tells the story of an asthmatic who was relieved at once in playing cards so soon as the stakes grew high.

The truth is, that the use of antispasmodics and anæsthetics is justified only in intensely acute cases, as those are wont to be which occur at long intervals, or in prolonged cases which continue severe. Milder cases, average cases, will content themselves with saltpetre-paper, a stramonium cigarette, a dose of antipyrine or quinine, a single dose of Dover's powder—at most a light emetic dose of ipecac, lobelia, or apomorphine—awaiting the relief which may be expected of the treatment of the cause.

The success of the treatment of the interval, the prevention of the recurrence of attacks, depends upon the ability to discover and remove the cause. In a certain percentage of cases the cause may be discovered

in the nose, and removed by the use of astringents, emollients, boric-acid ointments, more especially caustics, chromic acid, above all, the galvano-cautery, the extirpation of polypi, the reduction of hyperplastic tissue, the destruction of sensitive areas as localized often by 10 to 15 per cent. solutions of cocaine. All these methods have been followed by results as satisfactory as could be desired; this, too, in cases where other treatment has been tried for years. Adenoid growths in the naso-pharynx, affections of the tonsils, cicatrices, ulcers, various affections of the pharynx, more rarely of the larynx, trachea, and bronchi, have all served as excitants of the explosions of asthma. Tuberculosis in its earliest or least advanced stage is, in the opinion of the writer, an occasional cause of the so-called pure asthma.

Ducros recommended as a specific the application of ammonia to the pharynx—a treatment which is applicable to only a few individual cases. Trousseau used inhalations of ammonia with benefit in some cases. Dieulafoy paints the throat or sprays it with cocaine, 1 : 20.

The remedy which enjoys the highest repute in the treatment of asthma in general, without reference to discoverable cause, is the iodide of sodium, or, preferably, the iodide of potassium, in gradually increasing doses. The patient may begin with 10 drops of the ounce-to-ounce solution, and increase it to intolerance as manifested by coryza, with, in most cases, the most beneficial results. Of all the remedies which have been used in asthma, none deserves so much praise as the iodides, probably because they address a hidden cause, which may be enlarged glands, cervical or bronchial, irritating the vagus nerve. Every practitioner may recall individuals who remain free of attacks of asthma so long as they are under the influence of an iodide. It is the remedy which is to be tried first and longest. Large doses are best administered in milk. It is a rare case of pure nervous asthma, which is not at least benefited by the iodide of potassium, and many cases are actually cured by the persistent use of the drug.

Next is arsenic, which should also be given in gradually increasing doses up to the point of tolerance; then reduced, and continued in smaller dosage over long periods of time. Arsenic has manifold testimony as to its virtue. It was the remedy most relied upon by the older practitioners.

Quinine is of signal value in individual cases. It is best adapted to those varieties of the disease which show some periodicity or recurrence.

Leyden, finding that the crystals discovered in the sputum of asthma were soluble in the chloride of sodium and carbonate of sodium, recommended the inhalation of 1 part of each of these agents in 100 parts of water, twice daily in the form of spray. Fauth says that the carbonate of ammonium liquefies the spirals. He finds it of value, there-

fore, in the therapy of asthma. Little could be expected from the use of this remedy with our present knowledge of the relation to asthma of these structures.

Strychnine has its advocates in the form of solution itself or in the tincture of nux vomica given in small doses for weeks or months continuously. It has been followed in individual cases with good results.

Salter speaks highly of the use of alcohol in certain cases. It must be given hot and strong to be of any effect. Saturation with the bromides, as in the treatment of epilepsy, is perhaps the most efficacious treatment in aggravated cases.

It has already been intimated that many patients are relieved absolutely by change of climate. In this regard also asthma has its freaks. Patients in the country are relieved by going to the city, and patients in the city are relieved by going to the country; patients in valleys by mountain-air, and patients in the mountains by descending to the valleys. A moist, humid air will relieve most patients. Asthmatics are more often benefited at the seaside than in the mountains. So capricious is asthma that change of sleeping apartment from the ground floor to the upper story, or *vice versâ*, may have the same preventive effect. The truth is, the patient must find his own climate, must sometimes make changes, and must remain as long as he may in the climate which is best for him. Florida, Southern California, the Bermudas, Nassau, the sea or its coast, and the inland lakes, are points of selection.

Oxygen and compressed air are other resorts in the treatment of this disease. Patients are made to inhale compressed air in stationary rooms or portable apparatus for hours at a time—sometimes to effect a cure, oftener to give temporary relief, often to fail entirely. As a general rule, it is best to inhale compressed air and exhale into rarefied air. Those cases are most benefited which are most dependent upon bronchial catarrh. Asthma *per se* is little or but temporarily affected by pneumatic therapy.

The induced current of electricity—electrodes at the inner border of the sterno-cleido muscle, and sessions of from ten to fifteen minutes—has met with renewed advocacy by Schmitz, and has proven of value in exceptional cases.

No attempt will be made here to enumerate all the remedies which have "proven of benefit" or "acted like a charm" in cases of asthma. Pure asthma is too seldom accurately isolated from organic disease to enable us to define the action of drugs, and sorcery applies in our day to so few cases that, aside from a few plain principles, we are reduced to empiricism in the treatment of the disease. The aphorism of Bacon has application here: *Vere scire est per causas scire.*

BRONCHITIS.

General Considerations.

Definition.—Inflammation, for the most part infection, of the bronchial tubes.

Bronchitis is the most frequent of all diseases. It constitutes three-tenths of all internal maladies. It affects all ages, with especial predilection for both ends of life. It increases in frequency from the equator toward the poles. It is recognized in forms acute and chronic, circumscribed and diffuse, ascending and descending, with varieties according to the character of the secretion and the condition of the bronchial wall; but the division which has chief interest is into primary and secondary, the so-called idiopathic and symptomatic forms.

It is easy to understand the origin of cases of primary bronchitis caused by the action of irritating or irrespirable gases or dusts. Individuals employed in factories for the production of ammonia, chlorine, iodine, bromine, or strong mineral acids show occasional attacks of bronchitis until the mucous membranes become habituated to the action of these agents. So, too, it is easy to understand bronchitis or tracheobronchitis which results from the inhalation of steam, from the irritation of dust. Thus, engineers, bakers, millers, stonemasons, miners, brushmakers, polishers, housemaids who are engaged much in sweeping, furnish another contingent of cases of bronchitis. But the vast majority of cases of primary bronchitis arise independently of all these conditions, and are commonly ascribed to the process of taking cold.

Secondary bronchitis develops in consequence more especially of the infectious diseases. Bronchitis belongs to measles, to small-pox, and to typhoid fever, and constitutes an integral symptom of these diseases. Bronchitis is also frequently found in connection with diphtheria, universally in connection with tuberculosis, almost universally, at least periodically, in association with emphysema. There is also more or less bronchitis in pneumonia and pleurisy. Inasmuch as bronchitis shows itself in the infections in the first part of the malady, it is fair to assume that the poison of the disease lodges in the bronchial tubes in its reception into the body. The acute exanthemata are believed to arise from a *contagium virum*, and bronchitis is the first expression of the irritation of micro-organisms, as a diarrhœa results from the action of intestinal parasites.

Secondary or symptomatic bronchitis occurs also in connection with mechanical disturbances of the circulation—that is, of nutrition of—the bronchial mucous membrane. Bronchitis belongs to the later stages of heart disease, and shows itself in intensity in correspondence with the damage done to the heart. Thus, bronchitis is more or less

universal in tricuspid insufficiency. For the same reason bronchitis occurs in the course of cirrhosis of the liver or the kidneys. Every form of kidney disease which results ultimately in heart failure is attended with bronchitis. Bronchitis may arise also mechanically in the course of ascites or tumors of the abdomen of rapid course which interfere with the action of the diaphragm.

The bronchitis which belongs especially to the chapter of bronchial catarrh is the malady which begins in the bronchial tubes and which is ascribed to taking cold. "Catching cold" is really only a synonym for contracting disease, for bronchitis does not result from any change of temperature. Individuals plunge heated into a cold bath and emerge without bronchitis. Bronchitis is rare in the coldest regions; it is almost unknown in the Arctic zone. So also bronchitis is almost unknown in the prairies, in the open sea, at the tops of mountains—places where the air is rare and cold, not because the air is cold or rare, but because it is more pure. Colds are caught in doors, not out of doors. It is safe to say that most cases of bronchitis result from the action of micro-organisms of very great variety. Thus, it is known that typical bronchitis occurs in connection with tuberculosis and pneumonia. But that bronchitis may result from the action of micro-organisms indirectly, and be due rather to their products than their presence, is shown in the typical bronchitis of typhoid fever, which is caused by a bacillus that is never found in the bronchial tubes. Individuals who live in the outdoor air and who are subject to the greatest exposures, the most marked vicissitudes of weather, seldom suffer from bronchitis. Sailors have bronchitis on shore, not at sea; soldiers in barrack-life; inhabitants of cities rather than the inhabitants of the country.

Geigel states that more illegitimate than legitimate children suffer and die from diseases of the alimentary canal, but that more legitimate children die of diseases of the respiratory tract. Illegitimate children die from neglect, bad food, and legitimate from coddling and confinement to the house, protection from every exposure. House-air as contaminated by closed windows, ill-ventilated compartments, more especially by crowds in tenement-houses, public assembly-rooms, concerts, theatres, etc., schools and kindergartens, court-houses and post-offices, public buildings where men congregate and where the products of men accumulate,—these are the breeding-places of bronchitis. So the "cold" which is manifest on return from the theatre or the ball-room, if not present in latent form before, was caught in the room and not on the way home.

One of the most valuable acquisitions of our day in reference to bronchitis is the frequency with which it is caused by or is the manifestation of tuberculosis. Many cases of tuberculosis never go beyond

the stage of bronchial catarrh, which may show itself in exacerbations and remissions, the real nature of which is only discovered by an examination of the sputum. Statistics, such as are furnished by oculists in the examination of the eyes of children, when brought to bear upon the examination of the sputum of the school-room or of the workshop, the public hall, may alone show how widespread is the catarrhal tuberculosis which is now known in most cases simply as an innocent bronchial catarrh.

Acute bronchitis shows but few morbid changes, however diffuse the disease or distressing the symptoms. The condition fades, to leave no trace. The morbid anatomy of acute bronchitis is best studied during life, where it may be seen in the beginning of the bronchial tree. It has been abundantly observed that the same hyperæmia and swelling of the bronchial mucous membrane extends into the bifurcation of the bronchial tubes and into the body of the tubes as far as can be seen. It is seldom possible to see much farther than the bifurcation of the bronchial tubes. At this particular part the signs of inflammation are pronounced. There is more or less diffuse redness, distinct swelling, even tenderness to pressure from the outside, which pressure will at times beget an exceedingly irritating prolonged cough. A tough, tenacious mucus covers the surface. In more chronic cases the mucous membrane is more distinctly hypertrophied, more especially discolored to assume a slaty hue. Pigment deposits are found more or less abundantly distributed throughout the bronchial mucous membrane. Patches of atelectasis occur in connection with the emphysematous process in the vicinity.

Scarcely any disease varies more in intensity than bronchial catarrh, from the lightest grades of inflammation, confined to the mucous membrane of the trachea and main branches of the bronchial tree, which hardly show any symptoms at all, at least in adults, to more or less universal involvement of the finer tubes, with more or less complete occlusion, and hence dyspnœa, suffocation, convulsions—the picture of capillary bronchitis, with all intervening grades of intensity. Thus, the disease presents totally different aspects. Inflammation confined to the trachea and large bronchi furnishes, as a rule, in adults, but few symptoms. Constriction, irritation, a sense of rawness, more especially a sense of tickling, usually relieved by a sharp cough, which literally scratches the mucous membrane in this region, slight expectoration of tough, tenacious mucus, few or no constitutional symptoms, —this is the picture of ordinary bronchial catarrh as seen in adults. It does not in any way incapacitate the individual for work or, as a rule, call for the use of drugs. In childhood and advanced life the picture may be quite different, even though the disease be limited to this region. The narrower calibre of the tubes in childhood produces

a greater degree of stenosis, and the muscular failures of senescence lead to the accumulation of mucus, epithelial débris, etc., which may be aspirated into the deeper parts of the lungs, to lead here to symptoms of capillary bronchitis or catarrhal pneumonia. In childhood in these cases the cough is much more severe, the breathing more frequent, the distress from insufficient aëration of the blood more apparent. Duskiness of the face, cyanosis, somnolence, convulsions, coma, may occur in these cases, and are especially wont to occur where the individual is already debilitated by tuberculosis, syphilis, or rickets. The symptoms assume intensity in all cases as the disease attacks the finer bronchial tubes, until finally, when it invades the finest tubes, the so-called capillary bronchitis, the case assumes the gravity of real catarrhal pneumonia. In fact, the diagnosis between these diseases is wellnigh impossible.

Capillary bronchitis is recognized by the frequency of breathing, the respirations increasing to from 40 to 80 in a minute, by the increase in the fever, which shows temperatures ranging from 102° to 105°, by increase in the pulse-rate, 160 to 180, in correspondence with the elevation of temperature. Notwithstanding the increased frequency of breathing, dyspnœa becomes more and more pronounced, the occlusion of the bronchial tubes leads to atelectasis, and the lung can now no longer follow the excursions of the chest. This limitation of movement becomes apparent with every act of inspiration. The supra- and infra-clavicular fossæ, the intercostal spaces, the region about the insertion of the diaphragm, and the whole lower zone of the chest retract, and sink with every act of inspiration. It is thus established that the lungs themselves, blocked in their bronchial tubes, remain more or less immobile. The defective expansion is shown more distinctly in defective aëration of the blood. Cyanosis, which reveals itself first to the practised eye about the lips, spreads gradually over the face; the finger-nails assume a bluish tint. In the course of a few hours or a few days the extremities, then the whole body, become more or less distinctly dusky or blue. The anxiety of the patient becomes intense. Hereupon ensues the pitiable struggle for air, the silent, pain-inflicting appeals to relatives for relief. As the cyanosis increases the sensitiveness of the nervous system becomes gradually more obtunded, the struggle for air is less pronounced, the condition of excitement gives place to apathy, and there is at this time an apparent but illusory improvement. Convulsions ensue at any time during the course of this stage. Comatose states, sudden heart failures, put a merciful end to the scene.

The lighter forms of bronchitis show no physical signs on inspection. The chest movements are not inhibited. There is nowhere any consolidation. The air still finds access to the recesses of the lung, so that auscultation may disclose no sign of the disease. This is especially

the case in the tracheo-bronchitis of adults, which is revealed only by subjective signs, and more distinctly by the laryngoscope, when the lining of the membrane of the trachea may be seen to be inflamed, the disease concentrating itself more especially at the point of bifurcation. Here, however, as elsewhere, the tubes may be silent so far as physical signs are concerned. In the middle-sized tubes the diagnosis often rests upon the physical signs. This is more especially true of the differential diagnosis. There is still no limitation of the excursions of the chest. The chest-walls still rise and fall to the same degree as in the normal state. Mensuration shows no difference. No sign is yielded to percussion. Even slight lobular consolidation, more especially if central, may escape detection by percussion. All the more rich in signs is auscultation. As a result of thickening of the walls of the tubes an obstacle is offered to the entrance of air, and coarse groaning, humming, sonorous ronchi pervade the chest. What distinguishes them as belonging to this disease is not so much their character as their distribution. They are heard not only below the clavicles, but over the whole of the anterior surface of the chest—in the lateral regions also, posteriorly behind the clavicles and below. These dry râles are indicative of the stages of hyperæmia and occlusion by the swollen mucous membrane. They give place in the course of twenty-four to forty-eight hours to moist sounds produced by the exudation of fluid. Every variety of moist sounds may be heard in the chest, from the coarse mucous râle to the finest crepitation. It is here, again, not so much the character of the sound as its wide distribution which is characteristic of bronchitis. The râles are symmetrical; they occur in both lungs; they are confined to no particular region of the chest. What, again, distinguishes them is the fact that they appear and disappear. A more profound inspiration or expiration, more particularly a sharp cough, may change the râles from moist to dry, or dissipate them altogether for a time. Then they recur. The universality of the râles, their fugacity, their change in character, distinguish bronchitis from diseases which may show the same signs at certain periods or at certain places.

Capillary bronchitis is recognized for the most part by obvious signs. The frequency of breathing, the dyspnœa, the cyanosis, the fever, the nervous anxiety, above all things the retraction of the chest on inspiration, distinguish capillary from coarser forms of bronchial catarrh. In capillary bronchitis, which runs a more latent course, there is usually a history of catarrh which comes and goes, which seems more directly dependent upon the weather, which is present in the winter to disappear in the spring, or whose presence or absence may be determined by change of residence. There is a cough which remains unnoticed because of its long continuance. Old men have a coughing "spell" in the morning every day for years, and then are

compelled to cough little or not at all during the rest of the day. They must expectorate the mucus which has accumulated over-night. The disease is more or less continuously present in these cases, but is subject to exacerbations and remissions, and it is only when the exacerbation is attended by marked signs, as by increased fever, more violence of cough, pains in the limbs and joints, that the individual will say he has caught a fresh cold, and attention is directed to the disease. Not infrequently, the disease is recognized by the conscientious physician, who makes a thorough examination of the body in the hope of discovering somewhere a latent cause for the symptoms of prostration. In other words, a capillary bronchitis in general has the same history as a catarrhal pneumonia. There may be in cases no dyspnœa, no anxiety, merely an increased weakness, which confines the individual to his room, to his chair, to his bed, and of which the cause is not apparent. The physician ascertains that the pulse is quick, that the skin is dry, that there is fever, that the amount of urine is diminished, its specific gravity increased, and its color heightened, and he more or less suddenly comes upon the bronchitis in the course of his examination. The chest movements are feeble; respiration is more or less abdominal. The tape-line reveals not more than an inch difference, if that, between inspiration and expiration. There may have been made a diagnosis of general debility from old age. Percussion shows no dulness as a rule, though there may be strips of dulness along the spinal column—proof that the disease has associated unto itself a catarrhal or a hypostatic pneumonia.

Auscultation tells the story. A feeble, muffled, or absent vesicular râle, sibilant or sonorous ronchi, scanty tenacious expectoration tinged with blood, make the diagnosis. We look for the disease in childhood in connection with measles, small-pox, and typhoid fever. It is not infrequently a sequel of diphtheria. It belongs to tuberculosis in all parts of its course. It assumes gravity in childhood for the reason, as stated, that the tubes are finer, and the amount of swelling that would offer no appreciable occlusion in the adult lung produces stenosis in a child's lung. Then the tubes are shorter in a child's lung, so that diseased particles which would lodge somewhere along the surface of the big tubes of the adult penetrate to the recesses of the child's lung. Both childhood and old age are more liable to bronchitis from the fact that the power of expiration and expectoration is less marked. There is not the same resilience in the lung-substance itself, and there is not the same muscle-force outside the lung; so that in both these cases infections are liable to be introduced by aspiration from the mouth, from the throat, and from the upper into the lower bronchi. Mucus accumulated in the mouth and throat, mucus from the nose, epithelial débris, decomposing food, vomited matter, micro-organisms for which

the mouth is a reservoir,—all these materials may be aspirated into the recesses of the lungs to produce first a bronchial catarrh, later even a putrid bronchitis or gangrene of the lung itself.

Chronic bronchitis frequently occurs as a result of the acute form of the disease, especially as the result of repeated attacks of acute bronchial catarrh, but much more frequently as a result of other affections of the lungs. Thus, chronic bronchitis is a more or less constant companion of emphysema, tuberculosis, and chronic pleurisy, especially in its purulent form, empyema, and still more frequently it results from diseases of other organs which interfere with the circulation in the lungs. Thus, heart disease, kidney disease, and diseases of the liver are attended at some time or other in their course by bronchitis, subacute or chronic.

Chronic bronchitis distinguishes itself by its subacute character, not only as regards duration, but intensity of symptoms. Violent symptoms in its course betoken acute complications to which patients affected with chronic bronchitis are especially liable. The cough is not so frequent or severe, but continues over a longer time. Expectoration, on the other hand, may be much more abundant and different in many particulars. Dyspnœa is not, as a rule, so pronounced. It is a disease, however, which is by no means a trivial affection. It may be, and often is, followed by complications of gravity. Nearly all cases of long standing show some emphysema. The chief damage, however, is done to the heart as a result of long-continued cough and strain. There occurs hypertrophy of the right ventricle, which in time must result in degeneration, dilatation, and incompetency. There are presented then cyanosis, œdema, dyspnœa, syncope attendant upon heart failure, with, in more protracted cases, oliguria, with the consequences of stasis of the kidney, somnolence or insomnia, headaches, dropsies, and coma. So, while, as a rule, chronic bronchitis is not a disease of gravity *quoad vitam*, it has a more or less grave prognosis *quoad valetudinem*, and may in special cases, more especially cases debilitated by other disease, still more frequently in age, be attended through its consequences with fatal results. The fact is continually to be emphasized that chronic bronchitis is rarely a consequence of acute bronchitis. It is mostly a secondary malady due to affections of other organs.

Bronchitis is often divided into two forms according to the abundance of its secretion. Thus, there is a dry bronchitis, the *catarrhe sec* of Laennec. This form of inflammation attacks more especially the finer bronchial tubes, where the same amount of swelling produces marked occlusion, and is characterized therefore by dyspnœa which seems out of proportion to the physical signs. There is no expectoration; there is sharp dyspnœa, more pronounced cyanosis, anxiety, nervous unrest, and distress. This form of bronchitis is found frequently as a consequence, or in the course, of measles, whooping cough, and

tuberculosis; and, because developing gradually, is discovered more or less suddenly, especially in cases of apathetic, debilitated aged persons who have made no complaint that might call attention to the lungs.

On the other hand, there is a form of bronchitis which is attended by such profuse expectoration as to merit the name *bronchorrhœa*. The discharge consists of thin, watery, frothy matter which separates itself into layers. Pints or quarts of this fluid may be discharged in twenty-four hours. On rising from bed there is usually profuse expectoration of mucus that has accumulated over-night, more particularly in bronchiectatic cavities. The signs are not so distressing in this disease. There is no fever, there is little or no dyspnœa. The cough is not so harassing, because it is less continuous and more paroxysmal, and relief follows the expectoration of a quantity of fluid. Patients affected with bronchorrhœa may maintain a *bien-être* for years; the condition of health, however, in many cases becomes impaired daily, not infrequently because of associated, if not causative, tuberculosis. A particular alteration occurs in the sputum of some of these cases, constituting what is known as a *bronchitis putrida* or fœtid bronchitis. Putrid bronchitis seldom occurs as a primary malady or in people in perfect health. It shows itself in the course of ordinary bronchitis, usually in the course of bronchitis secondary to other diseases. The patient is more or less suddenly attacked by chilly sensations, followed by elevation of temperature, and then in the course of a day the discharge assumes a peculiar and offensive odor, a kind of a sweet, rotten odor, "that of the mayflower or apple-blossom," said Laycock, "with a kind of *arrière gout* of fæces." The matter separates itself distinctly into layers on standing, the upper layer, muco-purulent, frothy, with masses of more or less solid mucus from the coarser bronchi; the middle, a scanty greenish sero-albuminous fluid; and the lower, more or less distinctly purulent sediment, yellowish-green, the sediment consisting in large degree of smaller more solid caseous-looking masses, which Dittrich has shown to be expressions or casts of the finer bronchi, "Dittrich's plugs"—masses which crumble under pressure and evolve that unspeakably offensive odor which makes the patient an object of disgust to himself and every one else. One such patient will contaminate the air of a ward in a hospital, of a large room in a factory, or of a whole house. The odor may be recognized upon opening the front door. It is impossible to account for the sudden change which occurs in the sputum in these cases. It is easy to see that the sputum abounds with micro-organisms, fungi—Leyden speaks of a particular form of leptothrix—all the bacteria of decomposition, fat-products, and crystals; in fact, all the products of decomposition—sulphuretted hydrogen, ammonia, fatty acids, leucine, tyrosine—may be discovered in this sputum.

The disease is found in association at times with gangrene of the lungs, which makes itself manifest by the same offensive odor. But Traube has shown that the diseases are different; while they may coexist, they are more frequently independent.

This form of bronchitis does not cease suddenly as it began, but gradually if it cease at all. It is very obstinate to treatment. It shows itself in exacerbations and remissions for months, for years, sometimes for life. It might be supposed that this form of bronchitis resulted from the aspiration of products of decomposition from the mouth and throat into the lungs. Such an assertion may not be disproved, but it is a curious fact that individuals who work most with decomposing products, as tanners, scavengers, rag-pickers, show no predisposition to it. It is, fortunately, the rarest form of bronchitis.

A peculiar variety of bronchitis is offered in the so-called *fibrinous bronchitis*, or bronchial croup. This affection develops in consequence of tracheal croup or croupous pneumonia only as a very great exception. As a rule, the disease is secondary, and occurs in the course of other affections of the lungs, chiefly in consequence of ordinary bronchial catarrh. The cause of this peculiar transformation is entirely unknown. The individual will have been, as a rule, in the enjoyment of his usual health, or that degree of it which belongs to ordinary bronchitis, when he is seized suddenly with chills or chilly sensations, to be followed by fever and symptoms of great distress on the part of the organs of respiration. That is, there is more or less dyspnœa, great constriction, profound anxiety and feeling of impending suffocation, which indeed threatens and at times actually occurs. There is during the whole of the attack a most violent, harassing cough, which is attended in some of its explosive efforts with the discharge of casts of the bronchial tree. These casts alone establish the diagnosis. They may be recognized often with the naked eye as grayish-white masses of flesh-colored substances tinged with extravasated blood. They may be more readily distinguished, and are often only recognized at all, after immersion in water, when the branching of the bronchial cast is shown. They are thus distinctly casts of the bronchial tubes, and consist in the smaller tubes of solid masses of fibrin which have undergone hyaline transformation, enclosing a large number of white blood-corpuscles with a few red. The smaller casts are solid; the larger, hollow and composed of concentric layers.

The sudden development of the disease with acute manifestations after chill and fever has led to the belief that fibrinous bronchitis is an acute infection, and analogy would place it in the same category with diphtheritic croup and croupous pneumonia, of whose infectious character there is now no doubt.

The disease by no means always occurs in this acute form, though

much more frequently acute. The chronic form occurs also in the course of ordinary bronchitis, as a rule, but is distinguished by the milder character of the symptoms. It runs a course for the most part without fever, and is a malady consisting rather of exacerbations and remissions than of a continuous course. It is distinguished in its exacerbations by the same signs of distress as in the acute form, and is absolutely recognized only by the expectoration of casts of the bronchial tubes. Both forms occur especially in the young, between the ages of fifteen and thirty years, with exceptions, however, in the extremes of life. Kisch, for instance, reports the case of an individual aged sixty-six years who suffered from repeated attacks of fibrinous bronchitis, and who expectorated at times, over a period of twenty-five years, masses which looked like coral collections. Intervals of weeks or months, and sometimes even of years, with freedom from symptoms distinguish some of these cases of fibrinous bronchitis. Bugge, who collected the statistics of 90 cases with special reference to cause, found that the great majority followed in the course of chronic bronchitis and phthisis.

The acute form of the disease has a very grave prognosis, inasmuch as 25 to 50 per cent. succumb within fourteen days. The mortality in chronic fibrinous bronchitis ranges about 12 per cent. Chronic fibrinous bronchitis distinguishes itself not so much by the intensity of its symptoms and its mortality as by its complications. Emphysema, atelectasis, and catarrhal pneumonia ensue in a certain number of cases.

The character of the casts frequently locates the affection. Casts from the upper portion of the lungs subdivide more rapidly as the bronchial tubes of this part of the lung rapidly grow shorter. Ordinarily, bronchial casts are in their thickest portions about the size of goose-quills, and subdivide gradually to the size of threads. The cause of this peculiar transformation of the secretion of the bronchial tubes remains involved in obscurity, and, as Kisch declares, the treatment, like the etiology, is as yet unexplored territory.

The last variety of bronchitis is that pathological alteration in the walls of the bronchial tubes which permits their dilatation to constitute what is known as *bronchiectasis*. This condition was not known until the time of Laennec, for the reason, as he states, that dilatations of smaller tubes were considered as normal tubes of larger size, and great dilatations of larger tubes were looked upon as vomicæ or cavities of phthisis. A closer inspection of the dilated tubes readily distinguishes them from normal tubes by their size at the periphery, inasmuch as normal tubes grow smaller gradually; tubes pathologically dilated terminate abruptly. Bronchiectasis occurs more frequently in the upper anterior portions of the bronchial tree, and concerns chiefly a few tubes

of the third and fourth order. Tubes of the first order are never affected in this way. The disease is never primary, but occurs always in connection with other maladies, chiefly with long-standing chronic bronchitis, catarrhal pneumonia, and, more especially, tuberculosis. Corrigan in 1838 furnished the most satisfactory explanation of the development of most cases in his description of the fibroid condensations that occur in the lung, which were subsequently called interstitial pneumonias, later fibroid phthisis, and which we now consider to be relics in all cases of tuberculosis. The contraction of this hyperplastic mass of connective tissue, as in the process of cicatrization elsewhere, mechanically drags upon the tubes to force the deformity; and this deformity is aided all the more by the fact that the bronchial wall itself suffers from lack of nutrition, interruption of its circulation, and consequent degeneration. The deformity occurs in various forms, the uniform enlargement with cylindrical dilatation, with fusiform or spindle-shaped dilatation, sacular dilatation, with such consecutive sacular dilatations as to constitute the beaded appearance, or with such separation of the dilated portions, with retention of their contents as to form cysts in the lung—a very rare condition.

The *diagnosis* of bronchiectasis is by no means always easy, for the clinical picture is that of the underlying condition of chronic bronchitis or tuberculosis. There are therefore all the signs which belong to chronic bronchitis—cough, expectoration, interference with circulation, and dyspnœa, more or less pronounced. Somewhat more characteristic is the paroxysmal character of the cough and the discharge at intervals of large quantities of pent-up fluid. These mouthful or more copious discharges, however, speak for bronchiectasis by no means positively, as abundant discharges, paroxysmal in character, are often seen in simple chronic bronchitis, and more especially in tuberculosis; not infrequently, as is known, the discharge from an abscess below the diaphragm, as from the liver, takes place in this way.

Physical signs are not especially marked. The chest expands, there is no percussion dulness except in the presence of a very large cavity. Auscultation reveals only the signs that belong to chronic bronchitis or tuberculosis. The differential diagnosis of bronchiectasis from chronic bronchitis rests more upon the discharge of large quantities of fluid, as a rule exceedingly offensive from decomposition, at intervals. These symptoms, which may occur as episodes in the course of bronchitis, belong to the regular course of bronchiectasis. Tuberculosis is distinguished by its more or less continuous fever, its progressive emaciation, hæmoptysis, night-sweats, etc., and more particularly by the discovery of elastic tissue and the tubercle bacillus. Bronchiectasis has no definite duration. A developed deformity cannot be cured.

The treatment is that of the underlying condition upon the state or stage of which the prognosis rests.

Treatment.

Acute bronchitis is best treated by rest in the house, preferably in bed, and the use of diaphoretics. Thus, an acute cold may be often cut short by 10 grains of Dover's powder at bed-time, or by a grain of opium in any other form. Diaphoresis is often pleasantly and profusely excited simply by warm drinks, especially if preceded or followed by a warm bath. Common green or black tea taken hot and in quantity is a diaphoretic as effective as any of the nauseating teas or infusions of the materia medica.

In the acute bronchitis of childhood the warm bath plays the most important rôle if given three or four times in the course of twenty-four hours. It is nearly always followed by peaceful sleep. Should diaphoresis fail, the treatment becomes purely symptomatic.

In relief of the cough appeal is made to the expectorants. Chief among the expectorants in our day ranks apomorphine. A good prescription for a child is—

℞. Apomorphinæ hydrochlorat., gr. ss to gr. j;
Acid. hydrochloric. dilut., gtt. x;
Syrupi, f℥ss;
Aquæ menthæ piperitæ, f℥iss.—M.
Sig. A half to one tea-spoonful every two hours.

Apomorphine is a very soothing expectorant which acts like an anodyne, and, as has been proved by experiment, has real virtue as an expectorant. In bad cases of cyanosis and dyspnœa the remedy is best used subcutaneously in doses of $\frac{1}{12}$ grain, increasing the dose if necessary.

Ipecac in wine or syrup is a time-honored remedy, and, especially in the form of the compound mixture, has a wide range of use. 1 grain of tartar emetic dissolved in a glass of cold water, of which a tea-spoonful may be taken every hour, is an old and useful remedy. When the cough becomes more severe, and especially if it be associated with much pain, the necessity arises for the use of morphine, which may be incorporated with the apomorphine in the prescription above cited. Or the opium may be given in tincture, simple or camphorated; under no circumstances, however, should morphine be given to children. For an adult a prescription might read—

℞. Morphinæ sulphatis, gr. j;
Aquæ lauro-cerasi, f℥ij;
Aquæ, q. s. ad f℥ij.—M.
Sig. A tea-spoonful every two, three, or four hours.

The same relief, without risk, may be reached in children by the substitution of belladonna, which may given in the form of tincture in a dose of 1 drop for every year of the child's age. A few dry cups applied to the surface of the chest give great relief from pain at any age. Wet cups succeed when dry cups fail. Flying sinapisms often suffice. Where pain is very severe, in exceptional cases, especially in childhood, a poultice may be put about the chest.

For fever there is no remedy so good as quinine, which supports the heart while it attacks the fever. Many individuals learn to cut short a cold by a single dose of 10 grains of quinine fortified with a drink of hot whiskey, and whiskey or brandy is always a safe remedy to give to a child, with a smaller dose of quinine—not over 5 grains. Relief from fever is also given by the other antipyretics, such as antipyrine, which may be given to an adult in the dose of from 3 to 5 grains, to a child 1 to 2 grains; antifebrin in the same dose, or phenacetin in double the quantity. Phenacetin is the safest remedy. None of these drugs act so well in childhood as the warm bath, and where bronchitis has become capillary and dyspnœa assumes prominence or actual cyanosis has occurred, no remedy ranks in value with the hot or warm bath and cold affusions to the head and chest while in the bath. Juergensen has shown that a small stream of cold water directed to the nape of the neck will cause deep inhalations. A debilitated child will require additional stimulation in the form of senega, carbonate of ammonium, caffeine, or digitalis. One drop of the tincture of digitalis every hour or two is at times invaluable.

The treatment of chronic bronchitis varies more with the intensity than with the character or form of the disease. It is usually made a very long chapter, but the remedies which are of real value are few. Prophylaxis is the subject which merits discussion first. As has been remarked already, bronchitis is the most frequent of all diseases, and the greatest contingent of cases occurs in childhood. When we regard the manner in which children are reared in closed apartments, with defective ventilation, too warmly clad, for the most part not regularly bathed, in the ill-heated, ill-ventilated habitations that constitute what is known as the house-climate, it cannot be wondered at that bronchitis, a disease which results from the inhalation of a contaminated atmosphere, is so frequent. We have also to regard here, as well as in the case of adults, the frequency of tuberculosis, which has bronchitis as its forerunner for months and as its companion for life. Rickets too is a disease which belongs to childhood, and which has bronchitis as one of its prominent and more or less constant symptoms. These three causes—vitiated house-air, tuberculosis, and rickets—account for the large majority of cases of bronchitis. In children bronchitis belongs, therefore, to those who

are debilitated or diseased, and the factor of supreme importance in childhood is prophylaxis.

It is needless to say at this age that a house can be well ventilated, that sunlight and fresh air may be freely admitted, that the temperature may be regulated, that the house may be kept dry. It goes also without the saying that children affected with tuberculosis, rickets, and syphilis must be treated for these diseases. Phosphorus, iodine, creasote, cod-liver oil, iron, quinine,—these agents belong as much to prophylaxis as to treatment. Then comes the cold bath. Weak and debilitated children and adults are best inured by baths which should be warm at first, then tepid, cool, and even cold, with brisk friction to the skin until the surface is brought to a glow, the perfection of the reaction being the indication of the grade of temperature for the next bath. Fresh air, exercise, a shorter stay in school, a better ventilated school-room,—here is a subject which requires a chapter of itself. The regulation of clothing, the avoidance especially of heavy underwear, of mufflers and comforters about the throat, the exposure of the body until it becomes hardened like the face,—these are means which must be adopted gradually, that the body may become finally inured and, as it were, insured against bronchitis. A subject which deserves continued emphasis is the destruction of the sputum, which so often conceals the most dangerous parasites. Old men are best protected by avoiding vicissitudes of temperature, especially as connected with moist or windy days. On cold wet days the old man should remain at home in his room—in the chimney-corner if not in bed. The circulation of the old man is to be sustained by another meal if necessary, later in the night—by wine, brandy, or an extra cup of coffee or tea. Senile bronchitis may be avoided also by change of climate. Individuals whose circumstances will permit should seek the warm moist climates of Florida, Southern California, the Bermudas, Nassau, or the dry warm climate of Central Florida, Georgia, Aiken, Asheville, and the Carolinas.

Chronic bronchitis requires more continuous treatment. In the dry form of chronic bronchial catarrh exudation may be furthered or forced by inhalations. The agent of most value in these inhalations is steam, and it is best generated by a steam-atomizer. Simple atomizers without heat are of no value. The steam is given some additional solvent powers by the use of common salt, more particularly the bicarbonate of sodium in saturated solution, or disinfectant properties with carbolic acid, thymol, or boric acid. In capillary bronchitis steam is a necessity. Where the discharge is excessive in bronchorrhœa the best remedy is turpentine, which should be given in the form of capsules, containing from 5 to 10 drops. Capsules of turpentine are swallowed without taste with milk, or 5 to 10 drops of turpentine may be dropped into

a wine-glass of milk. Finally, turpentine may be smoked for a long time in a pipe. Here, however, there may be evidences of idiosyncrasy, such as slight cerebral disturbance and vertigo. A good substitute in these cases or in any case is terpin hydrate, which may also be given in capsules, 5 to 10 drops, or in pill, 1 or 2 grains, three or four times a day. The balsams of Peru, tolu, copaiba, and sandalwood have virtue in individual cases. Cod-liver oil is food as well as medicine. Many cases yield only to the prolonged use of iodine, which is best given, in the form of the iodide of potassium or sodium in peppermint-water, in the ounce-to-ounce solution, beginning with from 10 to 20 drops three times daily, largely diluted with milk. Its action is best suited to the cases complicated with asthma or dyspnœa. The best prescriptions for chronic bronchitis owe their virtue chiefly to the iodine they contain.

Putrid bronchitis requires antiseptics, which may be inhaled from the atomizer, as suggested above. Terpin hydrate is here also of value internally. A most excellent remedy recently recommended is myrtol, which should be taken internally in doses of 5 or 6 grains. Myrtol acts through the blood; it may also be inhaled. It lessens the excessive quantities of sputum in putrid bronchitis and bronchiectasis, diminishes the offensive odor or destroys it altogether, and often in the course of a few days puts a new phase upon a disease which has hitherto assumed alarming gravity.

Bronchiectasis has no special therapy. No drug can restore tone to or contract the dilated bronchial walls. The treatment is the same as that for chronic bronchitis, and more especially for putrid bronchitis, whereby disinfectant inhalations, more especially of terpin hydrate, menthol, and myrtol, play important parts. As has been intimated, the diagnosis of bronchiectasis or its differentiation from cavities in the lung from tuberculosis is by no means easy. Moreover, inasmuch as these cavities are scattered throughout the lungs, there is none of that hope from surgical intervention which might be entertained were the affection local.

In all cases of chronic bronchitis, especially where chronic organic changes have occurred in the bronchial walls, such as excessive hypertrophies, atrophies, decompositions of their contents, and ectasias, there is necessity for support with alcohol. Senega and serpentaria are considered good substitutes for squill, ipecac, and antimony in the debility of age. The carbonate of ammonium, best given in milk, is a remedy of value in advanced life or in extremis. The Germans have an anisated solution of ammonia which is a good preparation. Apomorphine is safe, quick, and pleasant. A remedy which is of signal virtue in the chronic bronchitis of the aged, in the capillary bronchitis which may not be separated from catarrhal pneumonia at either

end of life, more especially in the chronic bronchitis of old age associated with heart failure and kidney suppression, is nitro-glycerin, of which 1 or 2 drops of a 1 per cent. solution may be given every hour or two, or, to bridge over a sudden collapse, subcutaneously in doses of 1 to 5 drops.

To sum up the therapy of bronchitis, the best remedy in the treatment of the bronchitis of childhood is hydrotherapy; the best remedy in the treatment of the acute bronchitis of maturity is diaphoresis; for chronic bronchitis the discovery and treatment of its cause, whether tuberculosis, emphysema, heart disease, or disease of the kidney; the best remedy for senile bronchitis is support and change of climate.

WHOOPING COUGH.

General Considerations.

Whooping cough is an acute infection characterized by a series of breath-taking coughs, apparently threatening asphyxia, followed by a long-drawn, audible (whoop) inspiration.

The disease, considered first as a gastric condition, next as a catarrhal affection, then as a neurosis, has finally taken its definite place among the acute infections. Gerhardt goes so far as to remove it altogether from the category of lung diseases and give it a place between meningitis and cholera. Strümpell discusses it along with maladies of the bronchi. Fleischner more properly puts it between croup and mumps. Whooping cough is certainly an infectious disease, because it is contagious and prevails as an endemic and epidemic: because also of the absolute immunity which one attack confers. Rare as are second attacks of scarlet fever, measles, or small-pox, still more rare are second attacks of whooping cough. With the other infections it attacks preferably the age of childhood. Facts which have been taken to militate against the views of its infectious nature are the absence of fever and indefiniteness of duration.

Whooping cough consists in essence of a slight catarrh of the upper respiratory tract, especially of the larynx, and a heightened reflex of the vagus. As stated, the disease is contagious, and it is rare that one child only in a house is affected, yet there are differences in susceptibility. The disease occurs by preference between the ages of six months and six years. Girls, because of greater confinement to the house, are more frequently affected. Sucklings, because of protection, are rarely attacked, yet cases are on record where the disease has occurred in infancy and in advanced life. Susceptibility diminishes at six and is nearly annulled at ten years. In the exceptional cases in which the disease

occurs in advanced life it runs a mild or abortive course. Measles, pregnancy, and the puerperium predispose to pertussis. The contagion is conveyed directly.

The contagious principle exists probably in the sputum, hardly possibly in expired air, which contains no sputum. It is therefore a *contagium habituosum*. The great botanist Linnæus nearly two centuries ago expressed the belief that whooping cough was due to a *contagium animatum*, which he thought would be found to be the eggs of insects. The principle is thoroughly accepted in our day. The cause is believed to be a micro-organism, which, notwithstanding the claims of Hallier, Letzerich, and Bürger, remains still undiscovered and unknown. The contagious principle is not often disseminated without direct exposure to the disease. Thus very slight isolation secures exemption from the attack. The poison has no great tenacity of life. Cases in which the disease has been conveyed after weeks or months by clothing, curtains, or other fomites so common in measles, and more especially in scarlet fever, are very rare in whooping cough. The disease is spread by direct contact in families, and more particularly in kindergartens and schools, to assume endemic proportions, and cease only when the material is exhausted.

Whooping cough occurs with especial frequency, as stated, during convalescence from measles. The disease shows itself also in close relation to tuberculosis. It has long been noticed that tuberculosis often follows close upon the heels of whooping cough. It is impossible to say in a given case whether the whooping cough made the soil fertile or merely aroused the latent disease.

The name is derived from the fact that the cough is distinguished by a prolonged, forcible, and audible inspiration through a spasmodically contracted glottis. But many cases of whooping cough exist without this characteristic sound, and where different stages of the affection may be recognized the sound is absent during the whole of the first stage. The cough consists of a series of short, sharp explosions, spasmodic in their character; a series of expiratory efforts without interruption, until, finally, after the lapse of from fifteen to sixty seconds, at the point of exhaustion, occurs this prolonged audible inspiration. It is a series of explosive coughs in quick and uninterrupted sequence—the short sudden cough, the staccato cough, which marks a case of whooping cough.

In its ordinary course the disease may be divided into three stages: first, the catarrhal stage, which often commences as an acute infection of the mucosæ, coryza, photophobia, pharyngitis, rhinitis, and fever, but differs in no other way from ordinary tracheal or bronchial catarrh, and is recognized as whooping cough in some cases only by the fact that the disease exists in more marked form in the family, and that the

catarrhal attack suffices for future exemption. It may be added also that there is in this stage less hyperæmia and swelling of the larynx and trachea than can be recognized, as a rule, in bronchial catarrh. This common cold, so called, may last several weeks before the second stage—namely, the convulsive stage—occurs.

The neurotic element now assumes prominence; the cough becomes more continuous, severe, harassing. The intervals between the paroxysms are more distinct. Very soon the cough assumes the convulsive character mentioned, and sooner or later occurs this typical staccato cough with the long-drawn, audible inspiration. The case is now easily recognized.

In these attacks the seizure is very sudden. There is at most a sense of intense, irritative tickling in the larynx, which leads the child from its former experience to leave its play and run to its parents or grasp a chair for support. In the expiratory effort the breath is lost, the face becomes dusky and cyanotic, the eyes protrude, the vessels throb in the neck; hæmorrhages may occur from the nose, from the mouth. There are subconjunctival hæmorrhages which do not disappear with the subsidence of the cough. The membrana tympani rupture at times and free blood appears at the external meatus. Ectatic vessels burst in the skin of the face, in the cheeks, to show—visible at a distance—subcutaneous extravasated blood. Hæmorrhage from the stomach or intestine or from the kidneys or bladder is much more rare. Hæmorrhage into the brain, which does sometimes occur, is very much more rare. The stomach is subjected to so much compression as to lead to vomiting, and the discharges from the bladder or bowels, especially in young or debilitated children, may occur involuntarily.

The view that whooping cough depended upon catarrh of the larynx and bronchi found support in the investigations of Marcus, Loeschner, and Oppolzer. Herff more especially had the almost incredible fortitude to study the condition in himself. Watching his opportunities to investigate the larynx even during an attack, he found marked hyperæmia of the inter-arytenoid folds, the under surface of the epiglottis, with mucous deposits especially on the posterior laryngeal wall. He maintained that removal of these deposits jugulated the attack. Rehn in his studies found the posterior wall of the larynx perfectly sound, the anterior wall showing the most change; while Rossbach found all parts of the larynx and trachea without any pathological alteration. So that whooping cough has really no morbid anatomy except in its complications.

It is a very erroneous idea to consider whooping cough as a trivial malady. There occurred in England in the year 1877, of 500,341 deaths, 10,318 deaths from whooping cough. In New York in the decade from 1866 to 1877, where 4062 deaths occurred from typhoid

fever, there were 4094 deaths from whooping cough. Hagenbach says that whooping cough had more victims in Basle in the fifty years from 1822 to 1872 than any disease except typhoid fever and diphtheria. The general mortality is estimated at 3 to 5 per cent. It has reached as high as 48 per cent. in the second year of life.

The recognition of whooping cough in the convulsive stage is an easy matter. The series of rapid, sudden, explosive, breath-taking coughs, attended by the evidence of venous stasis, cyanosis—whence the old name, blue cough—which ceases only when a quantity of mucus, under the combined efforts of cough, retching, and vomiting, is expelled; the prolonged expiratory efforts, followed by a long-drawn, audible inspiration, which has been not inaptly likened to the bray of an ass; and the gradual cessation of the disease, sufficiently characterize it.

In the first stage whooping cough is not so easily separated from other forms of catarrhal affections. The age of the patient throws some light upon it. The presence or absence of disease in the history, more especially the existence of other cases in the family or community; then the obstinacy of the cough, the longer duration, the fewer physical signs to account for it; the more spasmodic character of it, with intervals of more complete exemption,—excite suspicion or confirm the evidence of the disease.

In the last stage there will have been generally a well-marked history of previous whoop in the cough, which may, indeed, be still occasionally heard. Here too there is a more marked interval between individual attacks than is common in the ordinary bronchitis; a slight nervous element still prevails. The cough will have lasted unusually long, six to twelve weeks; other cases in other stages of the disease are in the vicinity, etc.

The prognosis depends, aside from the condition of the patient himself, upon the severity and frequency of the attacks. A single explosion may last from fifteen seconds to an entire minute, and a series of explosions which constitute an individual attack may last from ten to fifteen minutes. The prognosis is grave where the attacks reach fifty in the course of twenty-four hours; at sixty it assumes special gravity. Individual attacks may do damage also by their intensity; thus hæmorrhage may be copious from mucous surfaces. Blindness occasionally results, probably from œdema of the brain. It is almost always temporary, and disappears with the subsidence of the œdema. Then, subarachnoid hæmorrhage, unusual as it is, is sometimes fatal. Such excessive vomiting occurs in certain cases as may not be stilled with the cessation of the attack, so that inanition may result. Psychopathies from the profound mental disturbance, fortunately usually temporary, are occasionally reported. Absolute exophthalmos has been produced

by excessive retro-bulbar hæmorrhage. Rupture of the membrana tympani, with subsequent otitis media, has resulted in deafness and, occurring in very early life, in deaf-mutism.

The disease has also sequelæ which make it dangerous. Bronchitis is frequently associated with it, whereupon may develop bronchiolitis, capillary bronchitis, and catarrhal pneumonia, which have their own special gravity. Emphysema is more rarely observed, and in consequence of it still more rarely pneumothorax. The frequency with which the disease is attended with, preceded by, or followed by tuberculosis has been remarked already. Thus it will be seen that whooping cough is by no means a trivial disease.

Prophylaxis.

As the disease has, at least at times, such gravity, prophylaxis assumes importance. The only prophylaxis worthy of the name is isolation. Isolation to be effective must be complete. The patient must be separated not only from children, but from adults who come in contact with unaffected members of the family. As this isolation in a disease which is usually considered so mild is practically impossible, attention should be directed rather to the protection of delicate members of the family; they should be isolated rather than the patient. It is advisable that tuberculous, rachitic, or otherwise diseased or debilitated children should be removed from the house as early as possible. Whooping cough is contagious in all stages of the disease. So long as there is cough, matter is expectorated, to be dried and disseminated, and thus to propagate the disease. In the removal of children from the house warning should be entered at the new place of residence, that the disease may not be developed in new centres.

The most essential element in prophylaxis at all times is the destruction of the sputum. Though the individual is attacked with the suddenness of an explosion, mucus, at least in quantities, is not expelled until the attack has spent itself, so that there is, for the most part, time for the collection of sputum in water. As in tuberculosis, the handkerchief should never be used for the reception of sputum. Perfect prophylaxis implies also the use of separate beds, the separate washing of bed-linen or the subjection of it to steam or dry heat, the use of separate utensils for food, the use of separate clothing, etc.

Treatment.

Until the specific nature of the disease shall have been determined there can be no question of any specific treatment, and remedies can be addressed only to its symptoms. The symptom which assumes prominence, and upon which nearly all the complications of the dis-

case depend, is the cough, and the nature of the remedy which is used against the cough will depend upon the view which the practitioner may take of the nature of the disease; that is, whether it be catarrhal, neurotic, or mycotic. The truth is, the treatment of whooping cough remains still in the stage of empiricism; and as nearly every remedy in the materia medica has been tried to relieve the cough, so appeal is made to every new remedy as fast as discovered. Young practitioners find specifics in every new remedy.

The older writers used the anodynes early. Opium in some form or other was the shield which was early interposed. In more modern times the active principle of opium, morphine, was and still is extensively employed. The following is a good prescription:

℞. Morphinæ sulphatis, gr. ss–j;
Aquæ amygdalæ amar., f℥ss;
Aquæ, f℥iss.—M.
Sig. A tea-spoonful every two to six hours.

With the morphine was often combined 5- to 10-grain doses of the bromide of sodium or potassium, or there may be added to the prescription the hydrochlorate of apomorphine, $\frac{1}{2}$ grain to $1\frac{1}{2}$ grains, or for the bitter-almond water or cherry-laurel water may be substituted $\frac{1}{2}$ an ounce of either glycerin or syrup, simple or of orange-peel, raspberry, etc. The remedies commonly employed in the treatment of bronchitis are also frequently resorted to. The syrup, simple or compound, of ipecac, $\frac{1}{2}$ to 1 tea-spoonful; the wine of ipecac in half these doses; minute doses of antimony, $\frac{1}{64}$ to $\frac{1}{32}$ of a grain; belladonna, 1 drop of the tincture for each year of life; or atropine, 1 grain to 1 ounce of water, given in doses of from 1 to 2 drops two or three times a day. The iodide of potassium is a remedy of value. It may be given as follows:

℞. Potassii iodid.,
Aquæ menth. piperit., *āā.* f℥ss.—M.
Sig. Two to five drops in a dessert-spoonful of milk three or four times a day.

The iodides are more used in cases in which the chest is full of râles; the ipecac preparations especially in the presence of burning irritation in the throat and chest; belladonna, the bromides, and morphine being addressed more especially to the spasmodic element.

Camphor, valerian, asafœtida, and musk have their advocates in the treatment of whooping cough. Chloral had at one time high laudation in doses of 3 to 10 grains. Chloroform, ether, the bromide and iodide of ethyl, and amyl nitrite—2 to 5 drops—were inhaled with the hope of

curtailing the attack; creasote, the salicylates, and carbolic acid, were remedies administered internally and by inhalation for the destruction of the undemonstrable mycosis. Various antipyretics, more especially antipyrine, in doses of from 2 to 5 grains every two to four hours, do certainly prolong the intervals and mitigate the severity of the attack. These remedies were recommended indeed as specifics a few years ago in the treatment of whooping cough. Saturation with the bromides, gr. x–xv, four times a day, is the treatment now most in use.

The mere mention of the names of remedies recommended from time to time in the treatment of whooping cough would consume the space allotted to the discussion of the whole subject. One remedy, however, deserves mention, if only because it is the last used. This is bromoform, which was recommended first by Stepp of Nüremburg. Löwenthal used it in Senator's polyclinic in 100 cases, claiming that it made the attacks milder in the course of a few days. Bromoform is given in drop doses, 2 to 5, three or four times a day. Children one year of age receive three times daily 2 to 4 drops; children from two to four years of age receive 3 to 4 drops three to four times daily; children from four to eight should receive three or four times daily 4 to 5 drops, according to the number and frequency of the attacks. The remedy must be protected from the light, hence in dark bottles with good stoppers. It is usually given dropped in water, when care must be taken that the pearly drops floating about in the water are swallowed. If the use of the drug is stopped too soon, relapses occur. No bad effects have ever been observed from these doses. One child which received a larger dose than had been prescribed fell into narcosis, but was readily revived. Fischer of New York reports 51 cases, claiming almost specific properties. The duration of the treatment was from ten to thirty days, and cure occurred in 75 per cent. of the cases in from two to three weeks if there were no complications. Neumann of Berlin is more temperate in his statements. He tried the remedy in 25 cases, and believed that it exerted a favorable influence upon the individual attacks, but had no real effect upon the course or duration of the disease. He was never able to cut an attack short even by early administration of the drug, though he never saw any ill effects. These conclusions represent the results which are generally admitted, so that it may be said that bromoform is the most valuable of the late contributions to the therapy of this disease.

Among the latest remedies recommended the following may be cited: Carbolic acid in aqueous solution, 1 : 120, of which ½ an ounce three or four times a day is advocated by Oltramare; hyoscine hydriodate by Edelfsen; turpentine, revived by Ringk; pilocarpine, to abort the disease, by Albrecht; chloride of gold and sodium, by Magruder; cocaine, by Krimke; peroxide of hydrogen, by Richardson; cyanide

of mercury, by Drzewiecki; resorcin, by Concetti; ouabaïn, by Gemmel; thyme, by Johnson.

Among remedies to be inhaled: turpentine, thymol, illuminating gas (carburetted hydrogen), carbolic acid, cocaine, sulphuretted hydrogen, tar, benzole.

Ledolier recommends chloral by rectal injection; Goldsmith sprays the nose with mercuric chloride or salicylates, and Rossbach applies the constant current of electricity.

PULMONARY EMPHYSEMA, ATELECTASIS, ABSCESS, AND GANGRENE.

By M. HOWARD FUSSELL, M. D.

EMPHYSEMA OF THE LUNGS.

As this paper will have to do solely with the treatment of emphysema, it will deal only with the vesicular form of the disease, and refer the reader to the various textbooks and monographs on the disease where the pathologically interesting form of interlobular emphysema will be found described. To Laennec is due the honor of the first accurate description of the pathology of this interesting condition, and, although his theory of its causation is not now generally accepted by pathologists as correct, he first placed the disease in such a light that its treatment was undertaken on a rational basis.

For purposes of treatment emphysematous patients may be divided into two classes: First, those with slight or moderate dilatation of the air-vesicles of the lungs; second, those in whom the process is far advanced, with great dilatation and some destruction of the air-vesicles and secondary changes taking place in other organs. Those belonging to the first class can be cured, or at least made very comfortable. Those belonging to the second class can be relieved of their urgent symptoms, and an almost unbearable condition rendered much less trying. Life may be prolonged, and in emergencies can be saved, but the condition of the lung and the secondary changes in the other organs can be but little affected by treatment.

Treatment must be directed to three distinct ends:

First, treatment of the general condition of the patient.

Second, treatment of the lesion.

Third, treatment of the complications.

Treatment of the General Condition of the Patient.—Accepting the view of Waters and his followers that the primary lesion of emphysema is a degeneration of the walls of the air-cells, treatment of the general condition of the patient becomes of paramount importance. Whether one agrees fully with this view or not, certainly a degeneration of the vesicle-wall does take place, and a treatment of tonic character directed to the building up of the whole system often

gives permanent relief from the distressing symptoms, and always is of benefit.

DIET.—In all cases the diet should be nourishing and digestible. Given a case in the beginning stage of emphysema, as indicated by a dyspnœa more or less constant, but distinctly worse on exertion, slightly prolonged expiratory sounds being the only physical sign, great care should be taken to avoid any food that will cause gastric disturbance, and especially attacks of flatulence. When the stomach and intestines are distended with flatus they prevent the easy descent of the diaphragm, and may increase a slight tendency to dyspnœa until one of the dreaded and harmful asthmatic attacks may be precipitated, which will add a certain amount of permanent distension to the already weakened air-vesicles. For extended remarks upon diet the writer refers to the article of Dr. Yeo in Volume I. of this System, but he cannot refrain from a few remarks upon the subject. He thoroughly believes that each patient is a rule unto himself, and must be studied alone, due regard being paid in all cases to the avoidance of fried foods, fast eating, and over-eating, the latter two evils probably being responsible for more attacks of indigestion than the materials taken into the stomach. A patient with a beginning emphysema should eat largely of meat, broiled or roasted, milk and eggs, with a view to giving tone to the system, that is beginning to show its weakness in the dilated air-cells. If the patient is more advanced in the disease, as shown by the more or less constant dyspnœa, with asthmatic attacks on the least indiscretion, the same diet, with an excess of milk over the solids, will be the proper one to follow. When great congestion of the liver, kidneys, and lungs, due to the failing heart, has taken place, then an absolute milk diet, which is at once the most nourishing and digestible, is best suited to the case.

EXERCISE.—In all cases not so far advanced that the mere act of walking will produce distressing dyspnœa, exercise should be taken. Great care should be used, however, that the golden rule, *Always stop short of the first sign of exhaustion*, is rigidly observed. In this, as in the dietary, no hard-and-fast rule can be laid down: what is just sufficient exercise in one case may bring on in another a paroxysm of dyspnœa, the effects of which will be felt for weeks. Increasing inability to breathe comfortably should be the first danger-signal, and whatever the form of exercise taken, it should be desisted from immediately upon the appearance of this distress. The form of exercise should always be mild. Severe strains on the heart, such as fast running, should be avoided. Under this paragraph I would urge the reader to caution his patient who is recovering from one of the complications of this disease, who finds himself for the first time out of doors, to observe the rule first spoken of. Such patients, I think, are

especially liable to take over-exercise, and will do themselves permanent injury by going beyond the mark.

MEDICATION.—Iron perhaps is the first drug to be mentioned; certainly it has a wider range of usefulness than any other one drug. Most cases will be benefited by it. All cases need it where the blanched mucous membrane of the lips and of the eyelids indicate an anæmic condition. Patients whose percentage of hæmoglobin is low may have the conjunctiva quite red, while the labial mucous membrane is blanched; hence the lips rather than the eyelids should be examined. Iron may be given in the form of the tincture of the chloride, 15 to 30 drops, well diluted, after meals. A convenient formula when for any reason it is not desirable to prescribe the medicine in drops is the following:

℞. Tincturæ ferri chloridi, f℥iij;
Glycerini, f℥j;
Aquæ, q. s. f℥iij.—M.
Sig. Two tea-spoonfuls in water after meals.

The deleterious action of iron in this form upon the teeth may be avoided first by dilution, and second by rinsing the mouth thoroughly after taking the medicine. If the whole dose is tossed into the back of the throat and quickly swallowed, much less of the liquid comes in contact with the teeth than by using a glass tube through which the liquid is sucked. Indeed, this method, so frequently prescribed, has always appeared to the author to cause the very thing it aimed to prevent.

Basham's mixture is a convenient and pleasant way of administering the tincture of the chloride. It has the advantage of a decided diuretic power, and hence may be prescribed, especially where iron is indicated and there is any congestion of the kidneys. The familiar Blaud's pill, which is the dried sulphate of iron in combination with the carbonate of potassium, is a very agreeable preparation, and at the same time efficient. The formula, as given by Osler in Pepper's *System of Medicine*, is:

℞. Ferri sulph. exsiccat.,
Potass. carbonat. et tartrat., āā. ℥ss;
Tragacanth., q. s.—M.
Fiat in pil. No. xcvi.
Sig. Two or three pills to be taken after each meal.

Flint's pill is an excellent form in which to administer small doses of iron. Each pill contains about half a grain of iron, combined with

all the inorganic salts in the proportion in which they are found in the blood, except chloride of sodium, which is in excess. It is known in the stores as the Saline and Chalybeate Tonic Pill of Flint, and one or two pills may be administered after each meal.

Some writers decry the use of strychnine in emphysema, on the ground that the seat of the lesion (the walls of the air-cells) contain no muscular tissue, and hence cannot be benefited by strychnine. This, theoretically, is correct, but when it is remembered that strychnine is one of the best general tonics we possess, it will be seen that to omit its use is to do away with one of our main stays in the treatment of all stages of emphysema, especially where the heart is beginning to fail. It may be given in pill form, beginning with a dose of $\frac{1}{20}$ grain three times a day, increasing this amount until some physiological action is observed. When strychnine alone is desired, a most convenient method of administration is to give a good tincture of nux vomica, beginning with 15 drops three times a day, and increasing the dose by one or two drops daily until 30 or 40 drops are taken three times a day, or until the physiological action of the drug is noticed.

Arsenic is perhaps second to iron in usefulness. It may be given as a general tonic, and is especially useful where the heart needs toning up. It may be given alone, in the form of Fowler's solution, in the dose of from 3 to 5 drops, well diluted, after meals, or in combination with iron and strychnine. A favorite pill, frequently used, is the following:

℞. Acidi arseniosi,
Strychninæ sulphatis, āā. gr. j;
Ferri redacti,
Ext. quassiæ, āā. gr. xxiv.—M.
Fiat in pil. No. xxiv.
Sig. One after each meal.

The proportions of strychnine and arsenic may be increased as the patient becomes accustomed to the dose. Practically, however, I have found that the above dose of arsenious acid is about as much as can be conveniently used for a prolonged period of time.

Cod-liver oil is an excellent tonic and a digestible food, and is frequently used in cases of emphysema where there is a moderate amount of disease and where the stomach will bear the drug. It is best to begin with tea-spoonful doses three times a day, and increase the dose as the stomach becomes accustomed to it.

Treatment of the Pathological Lesion.—The first condition found in emphysema has been described as a mere dilatation of the air-vesicles, such as takes place in the healthy individual in ordinary inspi-

ration. It may be said to be a chronic inspiratory state. Gradually the elasticity of the walls of the vesicles disappears, the walls thin out, and in many instances become entirely destroyed. In the early stages, before gross destructive changes take place in the walls of the air-cells, properly-directed treatment may permanently relieve this over-distension, and in all cases not beyond the hope of any relief may give marked comfort to the sufferer.

For a long time treatment of various pulmonary diseases by means of pneumatic cabinets has been practised. These cabinets were expensive, entirely beyond the means of the ordinary practitioner, and hence out of the reach of the mass of patients needing treatment. In 1871, Hanke suggested an apparatus by which either compressed air could be inspired or the patient could expire into rarefied air. This apparatus was improved by Waldenburg in 1873. This latter apparatus or a modification of it is the principal one now in use for the pneumatic treatment of lung affections, of which affections emphysema is perhaps the most favorably affected by such treatment. A brief description will not be out of place. The apparatus consists of an outer and inner zinc cylinder with attachments to be described. One end of each cylinder is closed, and the inner is inverted in the outer, with the closed end uppermost, after the manner of the ordinary gasometer. The closed end of the inner cylinder has two holes, one connected with a manometer and the other with a rubber tube fitted with a mouth-piece, the latter being provided with a valve by means of which the patient can expire or inspire, either into the atmospheric air or into the cylinder. Three uprights are fastened to the outer cylinder, over which run ropes through pulleys, these ropes having a weight at one extremity, and being fastened at the other to the inner cylinder. The outer cylinder is filled to a certain mark with water. The valve in the mouth-piece of the inner cylinder is opened, the weights removed from the ropes, and the cylinder allowed to sink in the water; the valve in the mouth-piece is closed, the weights attached to the ropes, and the cylinder rises, necessarily rarefying the air contained in the cylinder above the water, the amount of rarefaction of course depending upon the amount of weight attached to the ropes. If the communication between the cylinder and the outer air be now opened for an instant, the cylinder will rise, and the amount of rarefaction of the air will remain the same. If it is desired to use compressed air, the valve of the inner cylinder is opened and the cylinder drawn to the top; the valve is now closed, the weights removed from the ropes and placed on the top of the cylinder, the cylinder is depressed, and the air compressed.

The apparatus is used in the following way: The mask of the mouth-piece is pressed by the patient closely over the mouth and nose

with the left hand; the right hand is used to control the valve, so that he may expire into or inspire from the apparatus as desired. He breathes deeply in and out, keeping the mouth open while breathing. On an average a patient will exhaust the apparatus in from ten to twenty respiratory movements. He is allowed to use the apparatus two or three times at one sitting.

Patients allowed to breathe into rarefied air obtain most marked relief from the symptoms of dyspnœa which to them is the bad feature of their disease. The writer has been told by emphysematous patients that one sitting of expiration into rarefied air has given them more marked relief than any other form of treatment they have had. It not only relieves the symptoms, but it does so by allowing the over-distended air-cells to part with a more than usual quantity of air, and thus relieves not only the symptoms, but the cause which has become the factor which continues to destroy the elasticity of the air-cells. The pressure in the cylinder being less than that of the atmosphere with which the chest is surrounded, necessarily a greater quantity of air is driven out of the air-cells. If the lesion is not so gross that anything which relieves simply does so by mitigating the severity of the symptoms, and if the vesicles are not beyond all hope of restoration, this treatment offers the best means at our command for permanent relief, and even in bad cases helps to prevent further progress of the distension of the vesicles.

Though expiration into rarefied air is the usual method employed, it is known that *inspiration* of *compressed* air excites the circulation in the air-vesicles, and tones them up by the more rapid passage of blood through their capillaries. On this account it has been suggested, and by some who claim excellent results, that the patient should alternately inspire compressed air and expire into rarefied air. At this point the writer would refer to the admirable résumé of this subject in Dr. Cohen's article on "Tuberculosis" in Vol. I. of this SYSTEM.

For a long time manual compression of the chest during expiration has been practised as a most efficient means in aiding the labored expiration. If this method is practised systematically, it is claimed that permanent improvement can be gained. The chest is grasped by the patient's own hands, with the thumbs toward the spine and the fingers spread out over the anterior wall, strong compression being made during each expiratory act. The compression can of course be made by a second person, thus taking off a certain amount of physical exertion from the patient.

Based upon this practice of manual compression, Grunert invented and described in 1889 a so-called respiratory chair. In this apparatus a series of clamps are arranged to embrace the chest of the patient: these clamps are attached to levers worked by the patient's own hands. The patient is seated in the chair, the clamps are arranged on the chest,

and the levers grasped by the patient. During each act of expiration the patient presses on the levers and renders the act of expiration much more complete. The inventor cites a number of cases in which this apparatus has been used with benefit to his patients. The apparatus certainly offers an effective means of forced expiration, but as for general utility, it is not to be compared to the pneumatic cylinders.

Several forms of apparatus to compress the thorax mechanically have been invented, but they need not be described here.

Treatment of the Complications.—The chief complications to which the patient suffering from emphysema is subject are asthmatic attacks, bronchitis, heart lesions, and kidney lesions.

ASTHMA.—The article on "Asthma," by Dr. Whittaker, so thoroughly discusses this subject that it is hardly necessary for the writer to do more than point out the line of treatment which in his hands has seemed most useful in these cases.

On no occasion will the physician have a better opportunity of making a favorable impression on a patient than at this time. A hypodermic injection of $\frac{1}{4}$ of a grain of morphine, combined with $\frac{1}{100}$ or $\frac{1}{60}$ of a grain of atropine and $\frac{1}{100}$ of a grain of nitro-glycerin, will usually begin to give relief in fifteen minutes, and in half to three-quarters of an hour the relief will usually be complete. The writer has habitually used the above combination with the happiest results. The addition of nitro-glycerin to the well-known formula of morphine and atropine certainly adds much to its power of relieving the above-described symptoms. The nitro-glycerin does good by dilating the arterioles all over the body, and thus relieving the overburdened heart. If one dose of the foregoing is not sufficient to relieve the symptoms, it may be repeated in half an hour to one hour as circumstances indicate.

Hypodermic injections of cocaine hydrochlorate have been recommended by Dr. Thomas Dunn for the relief of attacks of spasmodic asthma, and might be tried in asthma from emphysema if for any reason the above prescription cannot be used.

If the patient is suffering from suppression of urine, and this secretion has been albuminous and has contained casts, then the use of morphine will be contraindicated and the nitro-glycerin may be used alone.

Venesection was largely used in early times to relieve the dyspnœa caused by the overburdened right heart. This practice has recently been revived with good results. Dr. Lafleur recently published a series of cases in the *Medical News*. That such treatment will relieve the symptoms there can be no doubt, but the writer must confess that, having seen the measures detailed above meet with such markedly good results, he would hesitate before drawing blood.

A patient who is subject to such attacks of asthma should be given a remedy that he can use in the absence of a physician. The sufferer may be supplied with a vial of a 1 per cent. solution of nitro-glycerin, and be directed to take 1 drop every fifteen minutes in water until the symptoms are relieved. He should be directed to notice the symptoms produced by the drug, and if there is much tinnitus or dizziness, with intense feeling of fulness of the head, the dose should be taken every half hour instead of every fifteen minutes. A vial of amyl nitrite may be supplied, and a few drops placed on a handkerchief and inhaled until relief is obtained or physiological symptoms such as are produced by the nitro-glycerin appear. When the physiological symptoms pass off, then the inhalation may be resumed.

Dried stramonium-leaves may be smoked by the patient during his attack, and frequently give much relief. They may be rolled into cigarettes and smoked, or they may be smoked in a pipe.

TREATMENT OF THE ACCOMPANYING CATARRH.—No one affected with emphysema is free from recurring attacks of bronchitis. Indeed, the Laennec theory of its causation is based upon the assumption that the inspiratory pressure is greater than the expiratory pressure. The bronchioles become plugged with mucus during an attack of bronchitis; the air which is inspired dilates the air-vesicles, and the expiratory pressure is insufficient to expel the secretion. This continues and a permanent dilatation is produced. On the other hand, the adherents of the expiratory theory hold that the bronchioles become plugged during a bronchitic attack—that the *expiratory* pressure is greater than the inspiratory, and, owing to the difficulty in expelling the air imprisoned in the air-cells, they are dilated by the strong expiratory efforts. Whichever of these theories is correct, or if there is truth in both, as seems most likely, bronchitis is looked upon as a causative factor in the production of emphysema. It is a well-recognized fact also that all persons affected with emphysema are subject to repeated attacks of catarrh of the respiratory mucous membranes.

Prevention of such attacks should be the object of the first efforts of both patient and physician.

Climatic treatment of the recurring catarrhs is probably the most rational of all methods, and should be employed whenever the time and means of the patient will admit of it. A climate should be selected for each case according to its needs. Where there is good bodily strength, a colder bracing climate can be selected than where the case is weak and needs careful watching as to excesses in bodily exercise. In all cases the two things to be desired and selected are equability of temperature with comparative dryness of the atmosphere.

However much the climatic treatment is to be desired, the vast majority of cases will not be able to avail themselves of it on account

of the cost and loss of time. Such cases must be treated at home, and can be successfully managed in many cases.

Exercise in the open air is desirable as directed above, and in order that this may be undertaken without danger the clothing must be of such a character that the person will be protected from the sudden changes of temperature so common in our most harassing climate. For this purpose wool should be worn next to the skin winter and summer, the weight of the material being lighter in the summer months and heavier in winter. The under-shirts should have high necks and sleeves reaching to the wrists; the drawers should be long enough to reach to the ankles. Wool as a good non-conductor of heat prevents the sudden chilling of the body, and its comparatively light weight makes unnecessary the weighing down of the body by additional coats and jackets, such as is habitually seen among the poorer classes of society.

Cold bathing indulged in daily may be undertaken by the more robust. It keeps the skin in good condition, invigorates the whole body, and renders the patient less susceptible to variations of temperature. If daily use of the bath causes discomfort in any way, it may be used three times a week or less frequently. The feet should always be kept warm and dry. So long as the patient is exercising, dampness of the feet does not so much matter, but as soon as the patient is at rest the damp stockings should be removed, friction applied to the feet, and dry stockings and shoes replace the damp ones. Woollen stockings with good stout leather shoes are preferable to lighter shoes covered with rubber overshoes. The latter prevent evaporation from the feet, and if long worn cause the very dampness they are intended to prevent.

A beginning cold can frequently be aborted by following Dobell's advice, given in his excellent treatise on *Winter Cough*. Such attacks are evidenced by chilly sensations, "stuffiness" of the head from beginning coryza, aching limbs, and more or less cough.

The patient is directed to take the following prescription at one dose:

℞.	Ammonii carbonat.,	gr. v;
	Morphinæ sulph.,	gr. $\frac{1}{8}$;
	Syrupi acaciæ,	
	Aquæ,	āā. f℥ss.—M.

At bedtime he is to take 1½ ounces of solution of the acetate of ammonium. He is to be wrapped in a blanket on retiring, and to remain in the house during the following day.

Every "cold" prevented from developing into an attack of bronchitis prevents that much strain to the already weakened lungs. If

the patient is seen in the first stage of bronchitis with dry cough, oppression under the sternum, with a tearing feeling in the chest with each paroxysm of coughing, with somewhat indistinct breath-sounds and a few sibilant râles, the following mixture has been found by the writer to be of signal value in increasing the secretion and relieving the engorged condition of the mucous membranes:

℞. Potassii bromidi,	ʒij;
Potassii citratis,	ʒiij;
Syrupi ipecac.,	fʒss;
Succi limonis,	fʒiss;
Syrupi,	q. s. ad fʒiij.—M.

Sig. Dessert-spoonful every two hours.

If the cough is unusually harassing, and by preventing rest causes loss of strength to the patient, the addition of $\frac{1}{25}$ to $\frac{1}{10}$ of sulphate of codeine or sulphate of morphine to the mixture will enhance its value. The potassium bromide in the mixture helps to overcome the spasmodic condition always present in such cases, while the potassium citrate and ipecac increase the secretion in the respiratory tracts.

If the attack is an exacerbation of a more or less chronic condition, the breathing is rapid, and the chest full of mucous and sibilant râles, then the following mixture is of the utmost value:

℞. Potassii iodidi,	gr. xxxvj;
Ammonii chloridi,	ʒj;
Syrupi scillæ,	fʒiij;
Misturæ glycyrrhizæ co.,	q. s. ad fʒiij.—M.

Sig. Two drachms every two or three hours.

Iodide of potassium in the writer's hands, as in the hands of most observers, has been of the greatest value. It has been lauded by some as a veritable cure for emphysema. Certainly it gives great relief in those attacks of bronchitis characterized by dyspnœa with the whole chest full of sibilant râles. It relieves and prevents the actual attacks of asthma to which the patients are subject, for which relief they are most thankful. The writer has seen patients who were so oppressed with dyspnœa, the breath-sounds being indistinct with prolonged sibilant expiration—in other words, in a sort of chronic asthmatic condition, and so unfitted for their duties that mere exercise was scarcely possible—so much relieved by a few doses of iodide of potassium in the foregoing mixture that they would declare themselves well, and the examination of the chest reveal entirely different conditions from those observed before the administration of the drug.

The dose of the iodide may be as great as 10 to 15 grains every three hours, though 5 grains every three hours is usually sufficient. The size of the dose is usually to be regulated by the urgency of the dyspnœa: the greater the dyspnœa, the greater the dose. Enormous doses can be borne by some such cases without causing any physiological symptoms.

If in addition to the dyspnœa there is weakness of the heart, with cyanosis, the patient should be given with the iodide 5 drops of tincture of digitalis, with 5 drops of tincture of nux vomica, every three hours. In all cases the patient should be at rest and not exposed to extremes of heat and cold, and in severe cases should certainly be at rest in bed. Rest in these severe attacks is of the greatest importance; some cases, which drag along for days while up and about, will respond at once to treatment when at rest in bed.

For the chronic bronchitis so generally present in winter in cases of emphysema doses of the above mixture of iodide of potassium and chloride of ammonium, given every four hours, are of great value.

Some cases with much expectoration and continuous cough respond well to oil of eucalyptus in 15-drop doses every three hours, dropped on sugar or given in capsule.

Terebene under the same conditions is sometimes of value, given in doses of 15 drops every three hours.

If there is a tendency to exceedingly large amounts of expectoration, with physical signs of a dilated bronchus, blowing breathing over the positions of the bronchi anteriorly or posteriorly, then inhalations of creasote, either by one of the numerous respirators on the market—of which, perhaps, Yeo's is as simple and cheap as any—or inhalations of eucalyptol from one of the various atomizers, may be tried.

In all cases the bowels should be regulated, it being seen that one good free movement is had daily. If this cannot be obtained normally, the following pill may be used with benefit:

℞. Aloini,
Resinæ podophylli, āā. gr. iij;
Extract. cascaræ sagradæ, gr. xij.—M.
Fiat in pil. No. xxiv.
Sig. One pill three times a day.

Cod-liver oil is unquestionably of great value when it is well borne by the stomach, but if it disagrees it does more harm than good, and should be omitted from the treatment.

Treatment of the Cardiac Complications.—The distension of the air-cells brings about, through the thinning, atrophy, and final disappearance of their walls, an obliteration of the terminal branches

of the pulmonary artery. This finally causes a gradual dilatation of the right side of the heart, connected with more or less hypertrophy, and finally of the left ventricle as well. The dilatation of the right ventricle under these circumstances has its most marked physical sign in the epigastric impulse. Owing to the distension of the parenchyma of the lungs, and consequent obliteration of the cardiac dulness, it is always difficult and frequently impossible to outline the limits of the right heart; consequently, the epigastric impulse becomes the chief physical sign. In some cases the dilatation is so great that the tricuspid valve becomes incompetent and a murmur results, systolic in time, with its area of maximum intensity just to the left of the sternum, at the junction of the sixth and seventh ribs. This murmur is rare, however. In the great number of extreme cases noted in the medical dispensary of the University of Pennsylvania but few instances of it are recorded. The symptoms are those of heart failure under any circumstances, œdema of feet, urgent dyspnœa, especially on exertion, œdema of lungs, and general cyanosis. Under such circumstances digitalis is the main stay of our treatment.

It should be given in doses of 1 fluidrachm of the tincture in twenty-four hours for the first two or three days, and then gradually reduced. This is the best possible mode of administration. Careful watch must of course be kept upon the pulse in order to detect the physiological action of the drug. Such a mode of administration, however, is less likely to be followed by untoward results than any other. Under these conditions strychnine or nux vomica can be pushed to its fullest extent with the best possible results. Strophanthus in the form of the tincture in doses of from 5 to 10 drops every three hours may be used with benefit. Sparteine sulphate can also be tried in doses of $\frac{1}{2}$ a grain four times a day, given either in pill or solution.

Iron and arsenic are of signal value in strengthening the flagging power of the heart. They may be administered as already advised, but can, and should under these circumstances, be pushed to their fullest extent. Above all other means of relief, and without which drugs are frequently of but little avail, is rest in bed. A patient suffering from a failing heart at rest in bed or reclining during the day in a chair will respond much more quickly to the use of digitalis and strychnine than when allowed to be up and about. All such patients should avoid any form of severe exertion. They should especially shun outdoor exercise in *windy* weather. The writer has in mind a man with organic disease of his heart, with such perfect compensation that he was entirely unaware of his illness, who was brought very near death by an acute pulmonary congestion brought on by walking in a high wind. In the attacks of dyspnœa which come on under such circumstances, and which partake largely of the nature of cardiac asthma, adminis-

tration of nitro-glycerin by the mouth, 1 drop of a 1 per cent. solution every half hour, as directed for the attacks of asthma so common in emphysema, is of the greatest benefit. Hoffman's anodyne may be used in half-drachm or drachm doses well diluted. Whiskey or some other alcoholic is useful, and it may be given in table-spoonful doses every half hour until some effect on the pulse is noticed. Hypodermic injections of nitro-glycerin and strychnine are also of great benefit. The latter may be given in the dose of $\frac{1}{30}$ grain every three hours. For hypodermic use it is best obtained in the form of tablets manufactured by the various manufacturing chemists.

Treatment of the Renal Complications.—The kidneys, as the other organs, partake of the general congestion, and help to make the condition of the patient more serious and more distressing. Albumin in the urine, hyaline casts, and sometimes granular casts, with increasing œdema, which may become general, together with headache, scanty urine, perhaps in extreme cases uræmic complications, show that there is present an actual disease of the kidneys. The treatment here is rest in bed, milk diet, digitalis, and diuretics. The diuretic which has given the most general satisfaction to the writer is 10 to 15 grains of acetate of potassium in an ounce of the decoction of scoparius (broom), given every two hours until a free flow of urine is obtained. Another favorite prescription is the following:

R. Nitro-glycerin. (1 %), gtt. xij;
Caffein. citrat., gr. xvj;
Aquæ, q. s. f℥ij.—M.
Sig. One tea-spoonful in water every half hour.

This will frequently start a flow of urine which will eventuate in much improvement of the symptoms described. In this condition Basham's mixture, with the addition of $\frac{1}{20}$ grain of strychnine to the dose will be found of value.

ATELECTASIS PULMONUM.

It was not until 1844 that Legendre and Bouilly[1] discovered that the lesion so commonly supposed to be a catarrhal pneumonia was in reality a return of the lung to the fœtal condition. The treatment of pneumonia at that time being debilitating in character, comprising copious venesection, purgation, and use of tartar emetic, this discovery was of the utmost importance to the welfare of the patients supposed to be affected with catarrhal pneumonia. Pneumonia is a disease characterized by inflammation, and was looked upon by the

[1] *Archives générales de Médicine.*

therapeutists of that day as calling for depleting treatment. Atelectasis, the condition so frequently mistaken for it, especially in children, is a disease of weakness, of lack of power in the whole organism, and characterized by a more or less complete collapse of the pulmonary tissue. To bleed such a patient was to entail almost certain death, and hence one reason for the large mortality in the pneumonia of childhood at that time.

With the discovery of the true pathology of atelectasis, the treatment has changed, and instead of the patient being bled to his death, he is now supported by vigorous methods until the lung has an opportunity to resume its normal condition.

Two great divisions of this most important disease are recognized by writers on the subject: *congenital atelectasis*, or that which is caused by accidents at the birth of the child, in which the lungs retain their prenatal condition after birth; and *acquired atelectasis*, in which the once normal and healthy lung for some reason, either local or general, returns to its fœtal condition or collapses. This latter condition is given the name, by some writers, of pulmonary collapse, as distinguished from the congenital condition.

Congenital Atelectasis.

Treatment of this condition resolves itself into the treatment of stillbirth. This state depends in certain cases upon circumstances which are remediable. Hence the prophylaxis of stillbirth is properly briefly spoken of in this place. Fuller and more explicit directions may of course be found in all standard obstetrical works. Quickly-repeated, long-continued labor-pains where the maternal parts are small or rigid, by interfering with the placental circulation, is one of the great causes of stillbirth. Even at this late date ergot is frequently administered to women in labor to hasten or strengthen their labor-pains. This is, of course, an entirely unwarranted use of the drug, and is against the best teaching. It need only be mentioned here as one of the conditions precipitating the above-described state, and to be dismissed with the admonition to the physician to delay the use of ergot in labor until the uterus is empty. The administration of quinine in doses of 15 to 20 grains, repeated every half an hour, will usually encourage the pains in a marked degree. The proper employment of forceps of course will always make unnecessary any such use of ergot as I have spoken of.

Care in the preservation of the membranes will frequently prevent the marked interference with placental circulation which results in devitalizing the child. Search should always be made for the cord about the neck, that it may be released as soon as possible and the placental circulation allowed to continue.

The proper administration of chloroform to the woman in labor will frequently prevent atelectasis. Insufflation of liquid by the child is one of the most frequent causes of the non-inflation of the lungs. Care should be taken that all liquids are swept away from the mouth before the child has an opportunity to breathe. When the child is born with a "caul," or with the membranes unbroken, it will frequently attempt to breathe before the rupture of the membranes, and hence inspire much of the amniotic fluid. This, of course can be remedied by rupture of the membranes as the head protrudes from the vulva. This should always be done, and the physician should never allow himself to omit rupturing the membrane for the purpose of pandering to the silly prejudice which attaches to the "caul." The head in breech presentations should always be delivered with as much rapidity as possible, in order that the child may breathe before the maternal circulation is too seriously interfered with. Due care must be taken in the use of the obstetric forceps that the pressure is not so great that the respiratory centres are interfered with, thus causing a lack of power in the child to take inspirations sufficiently forcible to inflate the lungs.

Two well-marked forms of stillbirth exist: the *anæmic*, in which the child is pale, cold, limp, and entirely without respiratory or other movement; and the *cyanotic* form, in which the child is cyanosed, rigid, and makes abortive attempts at breathing. The first form is much the more serious condition of the two: the atelectasis is almost complete and the vital energy of the infant almost *nil*, only a faint heart-beat revealing the existence of life. In the latter condition the lungs are only partially atelectatic, the abortive respiratory movements having had the effect of slightly inflating the lung.

Treatment of the Cyanotic Form of Stillbirth.—This is usually a simple matter, the difficulty always increasing as the anæmic form is approached. The cord is left untied. The nares and throat should be cleared and the mouth rid of mucus and other foreign material that may be found. This may be done by introducing the finger, first covered with a soft cloth, into the nares and mouth. It is best that the finger should be covered with the cloth, for the mucus will adhere more readily to it than to the naked finger, and there is less danger of injuring the child by the operator's finger-nail.

Cold water may then be dashed over the face and body of the infant. This will usually cause it to take a deep inspiration, to be followed shortly by regular respiratory movements.

Finally, the body of the child may be slapped or brisk frictions made. Failing in this simple means of restoration, it is advised by some that the cord be cut and from 1 to 2 drachms of blood allowed to escape. This seems to the writer to be bad practice: the child has no

more blood than is necessary; all that is wanted is its proper distribution and proper respiratory movements.

If all these methods fail, the cord is at once to be tied, and one of the methods of artificial respiration presently to be described is to be used.

Treatment of the Anæmic Form of Stillbirth.—In this variety the infant has every appearance of death, except the important fact of the feebly-beating heart. So long as the heart beats, be it ever so feebly, there is reasonable hope that the child's life may be saved. The cord must at once be tied, and no time lost before performing artificial respiration. First, the mouth and nares must be cleared, as previously directed, of all material which interferes with the ingress and egress of air. If this fails to remove the mucus, a catheter may be introduced into the trachea, compression made on the trachea below the end of the catheter, and air blown in forcibly. This will blow the mucus out of the mouth and nose. This method, recommended by Champneys in his excellent work on artificial respiration in 1887, is much to be preferred to evacuating the mucus by suction, as is generally recommended. Care must of course be taken that the catheter enters the trachea, and not the œsophagus. It is not a simple matter to pass a catheter into the trachea of a newborn child. It can best be done by introducing the finger into the mouth and placing it over the epiglottis. Using this for a guide, the catheter may be gently slipped into the trachea. Pressure should be gently made over the præcordia in order to stimulate the circulation.

Numerous modes of bringing about breathing in the child with congenital atelectasis have been advised. It will not be necessary to describe all here, as reference may be made to works on obstetrics, and especially to Champneys' work referred to above.

One of the best methods is mouth-to-mouth respiration, which may be performed by placing over the mouth and nose of the child a thin cloth, and through this blowing forcibly directly into its mouth. The air is then expelled by making strong pressure on the sides. This movement may be repeated fifteen to twenty times a minute.

Sylvester's method has in the hands of the writer been most successful, and by it he has certainly seen more than one child saved. The child is laid on its back, with its shoulders raised and supported with a folded article of dress. The tongue is drawn forward (if the glottis remains persistently closed a catheter may be introduced, and allowed to remain during the manipulations). The feet are held securely by an assistant. The arms are then seized above the elbows and *everted;* this eversion puts the tendon of the pectoralis major on the stretch, and thus gives better leverage on the chest-walls. The arms are then drawn upward alongside of the head, or, as the author prefers, *outward*

and upward, and held in that position with gentle traction. The arms are then brought down alongside of the chest and gentle pressure made upon the chest-walls. These movements are repeated fifteen to twenty times a minute. Great care should be taken that the movements are not repeated too frequently. I know of no temptation greater than to hurry under these circumstances. This method is simple and causes but little disturbance of the child.

Schultze's method, which is probably but little known or used in this country, has many advantages, but some disadvantages. If, however, Sylvester's method fails, it may be tried with a hope of success. The cord is to be tied. The child is seized from behind with both hands by the shoulders, in such a way that the right index finger of the operator is in the right axilla of the child from back forward, and the left index finger in the left axilla, the thumbs hanging loosely over the clavicles. The other three fingers hang diagonally downward along the back of the thorax. The operator stands with his feet apart and holds the child in the above-described manner, practically hanging on the index fingers in the first position, with the feet downward, the whole weight resting on the index fingers in the axillæ, the head being supported by the ulnar borders of the hands. This the first inspiratory position. At once the operator swings the child gently forward and upward. When the operator's hands are somewhat above the horizontal the child is moved gently, so that the lower end of its body falls forward toward its head. The body is not flung over, but moved gently until the lower end rests on the chest. In this position the chest and upper end of the abdomen are compressed tightly. The child's thorax rests on the tips of the thumbs of the operator. As a result of this forcible expiration the fluids usually pour out of the nose and mouth of the infant. The child is allowed to rest in this position (the first expiratory position) about one or two seconds. The operator gradually lowers his arms, the child's body bends back, and he again holds the infant hanging on his index fingers with its feet downward; this is the second inspiratory position. These movements are to be repeated at least fifteen or twenty times in the minute.

Respiration being established, the child should be wrapped in a woollen covering and laid on its right side, with head somewhat raised.

This section cannot be better ended than by quoting Champneys' final words:

"Do not hurry: it is not a question of seconds, and success depends upon a fine exercise of the judgment. Make a good diagnosis first as to life or death; secondly, as to the stage of asphyxia. If the child is macerated, it is obviously dead and past hope. If the heart beats ever so slowly and feebly, it is not dead. If the heart is

not beating, death is not certain unless it can be proved to have been inactive for a long time. If the child is livid and not flabby, it will probably come round; wipe out its mouth and pharynx, rub down the spine, and press gently over the cardiac region. If this produces no effect, or if in the pale stage, inflate the lungs by the mouth and by Sylvester's method. If air enters the lungs, well and good; if not, try Schultze's method or insert a catheter. . . . . Never be content until the child breathes regularly and appears to be continually improving."

On the days succeeding the birth the child's peripheral circulation may be hastened and aided by gentle friction over the body with alcohol. The child when weak should be kept on its right side, to aid in closure of the foramen ovale. If the circulation is very feeble, 6-drop doses of whiskey every hour may be given, well diluted. If the infant is too feeble to nurse, the breast-milk must be drawn by aid of a pump —one in which the air is withdrawn by suction with the mouth— and the milk given by means of a spoon.

Acquired Atelectasis.

Pulmonary collapse, the name given to this condition by Meigs and Pepper and other authors, was, as before stated, considered an inflammatory condition until its true pathology was pointed out by the French observers. This condition can occur at any age, but is most common in infancy. It is especially liable to follow and complicate a low adynamic condition, such as typhoid fever in the adult. It is not an infrequent complication of pneumonia, especially when the general condition of the patient is much reduced for any reason. It is especially common in weak and ill-nourished children affected with whooping cough and measles, and is a most common cause of death in these diseases. Knowing that atelectasis is a frequent cause of death in such conditions, the wise physician guards by all possible ways in his power against this complication. Children who are weak from inheritance or their surroundings are especially liable to this disease. If such a child is stricken with whooping cough or measles, it is the first duty of the physician to improve in every way the surroundings of the patient and his general strength. Practice among the poor with children and adults crowded indiscriminately in ill-ventilated rooms, ill-fed and worse nursed, is an entirely different employment from that among the rich, who are able to surround themselves and their children with every comfort. For the latter it is an easy matter to obey the commands of the physician and remove the child to the country or seashore. For a woman with an artificially-fed child, with five or six other children between infancy and puberty, with no money except for the mere necessities of life, it is an impossible task. Fortunately, however, the charitably disposed of our great cities

have made it a comparatively easy task for the physician to have his poor patient removed from the crowded tenements and enjoy the fresh air of seashore and country. When possible a child who is able to be moved, and who has a partial or threatened atelectasis, should be sent away from the crowded parts of the city, that its body may receive vigor from the fresh air and pure food. If this is impossible, then the mother should be encouraged to give the child exercise in the fresh air by taking it to the various parks accessible from all of our cities. Good food should be furnished, and tonics containing iron and strychnine given.

The compound syrup of hypophosphites, used in half tea-spoonful doses, well diluted and repeated every three hours, has been a most efficient remedy in my hands for improving the tone of the weak children which flood our cities. All this could and should be done as a prophylactic measure.

Besides whooping cough and measles, the diarrhœa which is such a fertile source of death among infants in cities is another cause which acts by its debilitating effect in bringing on severe attacks of atelectasis. Here the prophylactic measures above alluded to are eminently proper. The additional measure of care of the food must be taken with especial consideration. This subject is fully treated of in the article on Entero-colitis, but the author thinks it not out of place to give a few simple rules here for the guidance of the reader.

As is well known, entero-colitis occurs with far the greater frequency in artificially-fed children, and the selection of food becomes at once a most serious question. Cow's milk, when it can be secured in a good degree of freshness and purity, is undoubtedly the best substitute for mother's milk. The patients should be instructed to avoid purchasing that which has been hauled about the city for hours, and if possible it should be served twice daily. There are numerous reliable dairies in Philadelphia, and they doubtless exist in other cities, where pure milk can be obtained daily. It is part of the duty of the physician to make himself familiar with these places, and insist on his patients purchasing from them. Pure milk being obtained, it should be sterilized in the summer months. It is out of the question for many of the poor to purchase the patent sterilizer, and is probably unnecessary. Most efficient sterilizing can be done by the use of the ordinary boiler found in the poorest family, and some support for the bottles, such as an iron stand used for holding flat-irons. The stands are placed in the bottom of the boiler, and water poured in until it reaches almost the top of the stand. A number of bottles—the ordinary nursing-bottles answering perfectly—are well cleaned and filled with the milk, and stoppered with raw cotton which has been singed in a flame. The bottles are then placed on the stand in the

bottom of the boiler, the whole covered with a rather loose-fitting lid, and boiled from thirty to fifty minutes. The bottles should remain corked until the milk is to be used. This milk may be diluted one-half with lime-water or barley-water, and fed to a three months' old child in amounts of four ounces every two hours.

The milk may be predigested by the aid of Fairchild's peptogenic milk powder, which makes a most wholesome food.

If it is impossible to get good milk, or if the child cannot digest milk under any circumstances, then recourse must be had to some of the artificial foods. As a food malted milk has been a most useful one in the hands of the writer, and has the advantage of being easily prepared.

It would be manifestly out of place to go into the medicinal treatment of diarrhœa, but the writer cannot refrain from advising the use of salol in all cases of entero-colitis of children. Combined with bismuth and chalk mixture in such a prescription as follows, it will be found of signal value:

℞. Saloli, gr. xlviij;
Bismuthi subnit., ʒiss;
Mist. cretæ, q. s. fʒij.—M.
Sig. One tea-spoonful every two hours for a child one year old.

The bronchitis which accompanies and follows measles must be appropriately treated. As previously urged, tonics and hygienic surroundings are of paramount importance. Syrup of hypophosphites, cod-liver oil, and massage are of importance. The bronchitis is best treated by some such mixture as follows:

℞. Potassii bromidi, gr. xxxij;
Ammon. chloridi, gr. xxxij;
Syrupi scillæ, fʒij;
Syrupi tolutan., fʒj;
Aquæ, q. s. fʒij.—M.
Sig. One tea-spoonful every two or three hours.

If the bronchitis is capillary and the child weak, the addition of 2 grains of carbonate of ammonium to each dose of the prescription, and the omission of the squill, will be indicated.

The whooping cough may be treated with the above mixture used for the bronchitis, and the addition of belladonna to control the paroxysms. For belladonna to be of value it should be given in full doses. It is always directed to be given alone; for a child one year old 2 drops are ordered every two hours, to be increased until flushing

of the face or dilatation of the pupil is noticed after each dose. The bromide may be increased in the prescription suggested for the bronchitis until the child shows signs of bromism.

True Atelectasis.

A child with whooping cough, measles, pneumonia, or diarrhœa, or an adult with pneumonia or typhoid fever, may be progressing in an entirely satisfactory manner when suddenly atelectasis will supervene. This will be noted by sudden more or less severe cyanosis, coldness of the extremities, dyspnœa, and shallow respirations. The physical signs will be inspiratory retraction of the intercostal spaces when there is much lung involved, a dull or tympanitic percussion note, and faint vesicular breath-sounds. Under such circumstances the time for active measures has come. If the patient is suffering from pneumonia, and atelectasis of the unaffected lung has taken place, and whiskey and digitalis have already been used, they must now be pushed to their fullest extent. Strychnine may be used hypodermically in doses of $\frac{1}{30}$ grain repeated every three hours. Here hypodermic injections of nitro-glycerin, repeated every hour, will give excellent results in toning up the flagging heart. In children whiskey is perhaps the most reliable stimulant. The writer once administered to a child three months old, nearly dead from atelectasis complicating bronchitis, 15-drop doses of whiskey every fifteen minutes, with the result that the cyanosis disappeared, the heart became regular, and final recovery took place. Carbonate of ammonium, a good cardiac stimulant, may be used in the adult in doses of 10 grains repeated every one or two hours. Sinapisms to the chest are a most efficient mode of stimulating the weakened respiratory muscles.

GANGRENE OF THE LUNG.

Probably the most important element to be taken into consideration in the prognosis of a case of pulmonary gangrene is the condition of the patient previous to the manifestation of the disease. When a patient suffering from pneumonia, instead of progressing favorably to resolution, begins to expectorate fetid material containing gangrenous lung-tissue, with the sputum separating into three layers, so diagnostic of gangrene, there is the temptation for us to say, "All is lost!" Literature, however, abounds with cases of undoubted gangrene of the lung that have recovered after a more or less prolonged course. A very generally favorable element in all the cases is the excellent condition of the patient when attacked with the gangrene; therefore, if

we have a case of pneumonia in which the affected area has become gangrenous, or a case of foreign body in the lung which has caused a gangrenous focus, it behooves us to do all that is possible for the recovery of our case, instead of making up our minds that the patient will die and sitting by with folded hands.

Prophylaxis of gangrene of the lung is an important point in the treatment of all cases of pulmonary disease. The treatment of putrid bronchorrhœa, which so frequently antedates gangrene of the lung, is of the utmost importance. Improvement of the surroundings of the patient, with a liberal supply of fresh air and nourishing food, is necessary. The use of antiseptic mouth-washes and inhalations of carbolic acid, either dissolved in hot water or from one of the various respirators, to be used more or less constantly, will be found of value. Eucalyptol may be employed in the same way, or it as well as carbolic acid may be inhaled from one of the various steam-atomizers.

Since gangrene of the lung is a frequent occurrence in lunatics, improvement of the hygienic surroundings of such patients is important. When artificial feeding becomes necessary, care should be taken that particles of food are not introduced into the air-passages and by their presence there give rise to gangrene.

Traube has suggested the use of acetate of lead in pill form in 1-grain doses, repeated every second hour. He combines with this, when the fœtor has nearly subsided, $\frac{3}{4}$ to $1\frac{1}{2}$ grains of tannic acid. Chlorinated lime in doses of 30 grains has also been used. Carbolic acid may be given either in capsules or, preferably, in wine. It may be prescribed in the following manner:

℞. Acidi carbolici, gtt. xxiv;
Vini xerici, f℥vj.—M.
Sig. One table-spoonful every three hours.

The treatment by inhalations was first introduced by Skoda. The remedy most frequently used in this manner is oil of turpentine. This may be employed in one of the ordinary atomizers or by placing the turpentine in a cup of hot water and inhaling the fumes through an ordinary funnel.

Eucalyptol, which is probably as efficient as turpentine, has the advantage of a much more pleasant odor. It may be used in the same way. Carbolic acid may also be inhaled with benefit.

One of the most efficient vaporizers which has come to the notice of the writer consists of a chamber containing water, from the top of which leads a small exit-pipe ending in a mouth-piece filled with sponge. The substance to be inhaled is poured or dropped upon the sponge, and the water heated by means of a spirit lamp, which is fitted

to the apparatus. The steam passes out of the pipe, and through the sponge containing the substance to be inhaled. In this way most efficient vaporization of the substance is obtained.

While these measures may and should be undertaken in all cases of gangrene of the lung, the general treatment of the patient, together with that of the complications, is of the utmost importance.

Supporting measures must be at once adopted, and if, as will be most likely, the patient is suffering from some primary disease for which stimulants are being used, they must be supplemented by increasing the doses or adding other stimulants. Alcohol must be used in large quantities: the proper guide as to the amount of whiskey or brandy to be given, here as elsewhere when there is great depression, is not the amount used, but the effect upon the pulse and general condition of the patient. It should be increased until the pulse becomes fuller and stronger, until the dry tongue becomes moist, or until the delirium becomes less marked. So long as these improvements continue the alcohol may safely be increased: if the effect is the opposite from this, or if as an apparent cause of the large doses the pulse becomes weaker, the tongue drier, and the delirium increases, then it is time to lessen the dose.

Strychnine is a most excellent heart tonic, and is best given hypodermically. Certainly, the effect when administered in this manner is much more beneficial than when given by the mouth. In extreme cases $\frac{1}{30}$ of a grain may be administered hypodermically every three hours—at longer intervals of course when the symptoms are not so urgent.

Milk must be administered in large quantities; from three pints to two quarts in twenty-four hours.

Inhalation of oxygen has lately been advised as a useful method of treatment. This gas can now be obtained from manufacturers in receivers from which it can be directly inhaled.

Hæmoptysis, which is an occasional complication, must be met by the usual means of cold applications, ice by the mouth, rest, opium, and ergot.

Cough is best controlled by the judicious use of narcotics.

For the relief of the fever, quinine, administered in doses of 10 grains night and morning, is of the greatest value, both as a antipyretic and general tonic. The newer antipyretics, antipyrine and phenacetin, may be used in doses of 10 grains when the temperature becomes excessive. Remembering that the exhaustion produced by the disease itself is great and quite capable of causing death, antipyretics of the last-named group must be used with caution. It is the practice of the writer invariably to accompany the administration of these two drugs in antipyretic doses with a hypodermic injection of nitro-glycerin, and

to watch the effect of the antipyretic and repeat the nitro-glycerin if there is any tendency to collapse.

Catarrhal conditions of the stomach and intestine are frequently produced by swallowing the expectoration. These are best controlled by bismuth and opium. A favorite prescription in such conditions is the following:

℞. Morphinæ sulph., gr. j;
Bismuth. subnit., ʒij.—M.
Fiat in chart. No. xij.
Sig. One powder every two or three hours, as required.

Surgical treatment of gangrene of the lung in favorable cases offers in this age of antiseptic surgery perhaps the most hopeful means of procedure. If the gangrenous spot is situated near the surface, and can be definitely marked out, there is every reason to call in the surgeon to our aid. Several cases are on record where such procedure has resulted in saving the patient.

ABSCESS OF THE LUNG.

Little is to be said upon the treatment of abscess of the lung which will not apply to the treatment of gangrene. In both, disinfectants, such as carbolic acid and eucalyptol, may be used by the mouth and by inhalation. Stimulants must be pushed as in gangrene of the lung, and the various complications treated in the same manner.

The surgical treatment of abscess of the lung has of late claimed the attention of physicians and surgeons. Many cases are on record which have recovered after surgical interference which had given every evidence of succumbing under purely medical treatment. If the abscess can be definitely made out, and is believed to be solitary and not multiple, everything points to the propriety of surgical treatment. This is manifestly not the place to describe the operation to be undertaken; it must be left to the good judgment of the surgeon consulted. However, when a case in which there is evidence of pus begins to fail, an exploratory puncture may be made to establish the diagnosis, and then active measures, either puncturing with a large trocar and inserting a drainage-tube, or making a free opening and giving vent through a large tube. This latter measure appears to have given much better results in the cases reported than the mere draining by a small opening.

Necessarily, stimulation, antipyretics, and general tonic treatment must be continued until the complete recovery of the patient.

ŒDEMA OF THE LUNGS.

ŒDEMA of the lungs is never a primary affection. Occurring as it does in the course of other diseases—notably, Bright's disease and organic heart disease—its treatment properly belongs to the consideration of the complications of those diseases.

However, as the physician occasionally first sees his patient with pulmonary œdema as the chief condition to be treated, it is perhaps best to consider it briefly in this place.

A patient with more or less cyanosis, urgent dyspnœa, frothy expectorations, and with his chest filled with mucous râles is suffering from an attack of pulmonary œdema. If this attack has occurred in the course of acute or chronic nephritis, diuretics, diaphoretics, and purgatives will probably give the best results. If the patient's heart is fairly strong, a hypodermic injection of from $\frac{1}{8}$ to $\frac{1}{6}$ of a grain of pilocarpine can be administered with good results, or the patient may be given a hot-air bath. A large funnel may be placed over a lighted spirit lamp, and the small end of the funnel inserted under the bed-clothing. In a very short space of time the air in the tent formed by the sheet will be superheated, and will bring on a profuse sweet. An efficient steam-bath may be originated in a few moments by filling bottles with very hot water and drawing over them stockings dampened in warm water, the bottles thus covered to be laid under the bed-clothing next to the patient. Diuretics will probably be less efficient, on account of the length of time it takes for them to act.

Purgatives in the shape of $\frac{1}{8}$ or $\frac{1}{4}$ of a grain of elaterium, or the compound jalap powder in drachm doses, may be given when the strength of the patient will allow it.

When these depleting measures are used it will be well to support the heart with hypodermic injections of strychnine, $\frac{1}{30}$ of a grain, or of 15 minims of tincture of digitalis, or 1 or 2 drops of a 1 per cent. solution of nitro-glycerin. If the œdema is dependent upon a weak heart due to organic heart disease or other cause, then the proper treatment is the free use of cardiac stimulants.

Hypodermic injections of a 1 per cent. solution of nitro-glycerin have been of signal value in the writer's hands. In the *Medical and Surgical Reporter*, June 2, 1888, the writer reported a series of cases of heart failure treated by this method. His experience since that

time has amply justified the conclusions drawn and confirmed him in its use. It may be given in doses of 1 drop in water every half hour until relief is obtained. Hypodermic injections of whiskey, strychnine, and digitalis should be given for their more lasting effects. By the mouth whiskey, Hoffman's anodyne, and aromatic spirit of ammonia may also be given.

In that form of œdema coming on in the course of fevers it will be well to change the position of the patient as frequently as practicable, in order to prevent a portion of the lung from being continuously in a dependent position.

HYPERÆMIA OF THE LUNGS AND PASSIVE CONGESTION OF THE LUNGS.

HYPERÆMIA of the lungs or active congestion, coming on from over-action of the heart, may cause so much embarrassment of the respiration that venesection is called for, but usually dry or wet cups to the chest, with hot mustard baths and the administration of full doses of aconite, will give the desired relief.

In such cases the disturbing element, if it be excitement or undue use of stimulants, must be removed. Where the condition is due to mental emotions, bromide of potassium in from 30- to 60-grain doses will be of benefit.

Passive congestion of the lungs, which usually occurs in the course of some adynamic fever, calls for an opposite mode of treatment. Here the heart is weak, and needs stimulation with whiskey, digitalis, and strychnine. The position of the patient in bed should be frequently changed, as in cases of œdema due to the same causes.

PULMONARY EMBOLISM.

WHEN emboli of the pulmonary artery have their origin in valvular lesions of the heart or in some septic focus, such as a puerperal uterus or an abscess, treatment must be entirely symptomatic. One form of emboli, however, those which have their origin in the clot of an occluded vein, may to a great extent be prevented by rational treatment of the inflamed vein. First among these prophylactic measures is rest. No patient with a phlebitis of the saphenous vein should be allowed out of bed until all symptoms of active inflammation have subsided, and until the clot is firmly adherent to the walls of the vessel. The limb should be kept in a slightly elevated position

and lightly bandaged with a flannel roller. When other veins are involved, due care should be taken that the clot is left undisturbed until absorption has begun to take place. If the infarcts to which the emboli give rise should suppurate, then the case becomes one of abscess or gangrene of the lungs, and should be treated accordingly.

TUMORS OF THE LUNG.

The treatment of tumors of the lung is necessarily unsatisfactory, with the single exception of cystic tumors. Little beyond a general supporting treatment is available.

The distressing symptoms connected with respiration may be alleviated by rest, posture, and narcotics. Cystic tumors, when it is possible to diagnosticate them, may be incised and treated on surgical principles. Surgical interference with other varieties of tumors is of no practical value.

Echinococcus cysts may be treated as other cystic tumors, with possibly more hope of permanent relief. The cyst may be incised and thorough drainage kept up, in order, if possible, to get rid of all the hydatids.

CROUPOUS AND CATARRHAL PNEUMONIA.

By EDWIN E. GRAHAM, M. D.

CROUPOUS PNEUMONIA.

General Considerations.

The treatment of croupous pneumonia must necessarily be influenced by our opinion of its causation and pathology. Exposure to cold, the excessive use of alcohol, improper nourishment, bad hygienic surroundings, nervous shock, severe injuries, or any cause that depresses the vital forces, predisposes the individual to pneumonia. Certainly, unless we accept this explanation of its origin, the exciting cause of many cases of pneumonia must remain in doubt.

On the other hand, from the studies of bacteriologists it would appear that croupous pneumonia is not invariably due to a single cause, and that cases differing neither in symptoms, physical signs, nor post-mortem lesions may originate under quite different conditions. Nevertheless, after carefully considering all the circumstances, the weight of evidence clearly tends to the belief that the lung inflammation probably depends on an antecedent change about which, histologically, we as yet know nothing. Thus pneumonia—or rather the processes in the lung which have previously been so called—occupy but a subordinate place in a series of phenomena of which the lung-changes are only a part. It does not, however, come within the scope of this paper to discuss this aspect of the subject. All must admit, however, that as regards the bacteriology of pneumonia there is as yet scarcely sufficient evidence to establish the dependence of the disease upon one specific germ.

Whatever opinion we may hold as to the causation, it must be admitted that in the typical form of the disease manifestations of inflammation in the pulmonary structure are uniformly present. Pneumonia, unlike other inflammations, is seldom produced by artificial means, nor have we, as is usual with inflammations in other organs, a definite line of symptoms following, *pari passu*, the progress of the inflammation in its full extent and severity. The physical signs of consolidation may not develop until several days after the appearance of the pyrexia, and the ratio of fever and area of lung involved is often far from constant. Considerations such as these, together with the knowledge that inoculation has been successful in

exciting the disease in animals, such as mice, guinea-pigs, and rabbits, and that no affection due to a local cause produces symptoms so definite in point of time as croupous pneumonia, are opposed to the view that pneumonia is nothing more than a local inflammation.

Realizing, then, that we do not have to contend with an inflammation, but rather with a constitutional disease, and one, moreover, of comparatively short duration, we readily adopt an expectant treatment, ever alert, interfering only when necessary, and not seeing in the mere name of the disease any special indications for treatment. The tendency in all acute infectious diseases is toward cure, and the physician's duty is clearly to sustain life until recovery takes place. Each case must be treated by itself, the prognosis in any given case often largely depending upon the skill the physician employs in combating each indication as it arises. One point, however, must always be remembered—namely, that all measures which tend to depress the heart must, whenever practicable, be avoided.

To just what extent we can influence the natural progress of pneumonia or hasten its usual course is, however, uncertain. But we can often assist our patients through critical periods of the disease and moderate the intensity of the attack by relieving any special symptoms as they arise. It is quite possible, indeed, to render valuable aid in every stage of the affection. In the first stage the pain may be relieved and the pyrexia or delirium lessened. During the second stage the dyspnœa, heart-failure, or, in fact, any dangerous symptom that may arise, can be, at least to a certain extent, influenced. The treatment in this stage is mainly directed to promoting resolution, combating symptoms, and supporting the powers of life.

Bloodletting is therefore rarely admissible in the second stage, and all but mild laxatives are contraindicated, as it is now clearly impossible by either of these measures to remove the solid inflammatory exudate. Tartar emetic, as used by Laennec, at this stage can only be harmful. Blisters, except in those instances where resolution is delayed, should not, as a rule, be employed. The tincture of iodine, as advised by Flint, will excite all the counter-irritation desirable. Opium must also at this period be used with caution, as accumulations of mucus may be present in the bronchial tubes, and opium by checking cough increases the dyspnœa.

Expectorants are only occasionally indicated: they exert little or no influence upon the exudate, though they may be beneficial if a considerable amount of bronchitis is present. The great danger at this period is not from the lungs, but from a failure of the heart and vital forces. Hence a supporting plan of treatment is indicated: these measures should, moreover, be instituted before marked symptoms of failure of the vital powers are noticed. Otherwise it may be too late.

In the stage of resolution stimulants and tonics are most useful. Supporting measures embrace stimulants, tonics, nourishment, and sponging, the latter being not only a sedative, but a tonic to the nervous system. During the third stage convalescence is usually rapid. If resolution is tedious, occasional blisters, the iodides—especially the iodide of ammonium—and cod-liver oil will be found of service. Complications must be treated if necessary. Leeching and blistering are of doubtful utility in children, while ipecac in small doses and stimulating expectorants are of more service than in adults. In children and adults the ordinary cotton jacket answers a very useful purpose, protecting the chest from becoming chilled by exposure during diaphoresis. In young children the condition of the bowels should be carefully watched.

The diet in pneumonia should be light, nourishing, and easy of digestion. Care must be taken that too large a quantity is not forced upon a weakened stomach, lest nausea and vomiting ensue and the patient be injured rather than benefited. Anxiety to preserve the patient's strength by large quantities of nourishment has undoubtedly often led to this error of over-feeding. The diet should be regulated, as far as is possible, by the patient's own tastes and desires. Milk-punch, egg-nog, mutton or chicken broth, beef-tea, beef-juice, or beef peptonoids will in the majority of cases answer the purpose admirably. If a coated tongue, nausea, anorexia, slight jaundice, epigastric uneasiness, and constipation are present—*i. e.* symptoms of a mild gastric and duodenal catarrh—the condition will only be aggravated by forcing upon the patient nourishment which the stomach is utterly unable to digest. A mild laxative, such as calomel, with cracked ice, iced carbonated waters, or iced champagne, and liquid nourishment in small quantities every two or three hours, will usually quickly relieve the digestive disturbance and allow of larger quantities of nourishment being assimilated.

The room should be large and well ventilated, lighted to suit the wish of the patient, the temperature about 70° F., and the air kept moist by the occasional use of a steam atomizer or other means. All noise or loud talking should be interdicted, and if possible the physician and nurse be the only attendants. The patient should be assisted in all his movements, and kept in as comfortable a position as possible.

In order that our treatment of pneumonia should correspond with the modern view of its pathology, the so-called antiphlogistic method —bloodletting—as a means of cure must be abandoned, only employing it if certain definite conditions are present. For the same reason large doses of tartar emetic should no longer be prescribed, and indiscriminate blistering, especially in the early stages, must be strongly condemned.

It must not be forgotten that uncomplicated pneumonia of moderate intensity will usually, in a vigorous patient, if untreated, end in recovery. In fact, uncomplicated pneumonia in robust subjects requires little or no treatment. In asthenic cases the employment of stimulants, nourishing food, and tonics may, however, be necessary from the onset of the attack. Digitalis may be needed to stimulate the heart's action, or veratrum viride may be required to slow its beat.

Absolute rest in bed is necessary. The patient should for the necessary examinations of the chest preferably be turned from side to side rather than be raised up in bed. This is especially important if the first sound of the heart is weak and the pulse rapid or irregular. The application of leeches, wet cups, hot flaxseed poultices, or cold compresses will relieve the pain in the side. Dry cups applied to the chest will at least temporarily relieve dyspnœa and œdema; and a cotton jacket, especially if covered with oiled silk, such as is commonly employed in the large hospitals of Philadelphia, will both protect from draughts and be a source of comfort.

It has seemed to the writer that a clearer exposition of the treatment of croupous pneumonia would be possible by specifying, as has been done on the previous pages, the general considerations of treatment, followed by special lines or methods which are only to be employed when certain symptoms or conditions are present. What has already been written will suffice in the majority of instances for the management of uncomplicated cases. Often, however, our treatment must be directed against one certain symptom, as pyrexia or a condition of collapse. These we will now proceed to discuss.

Treatment of Symptoms.

Pain.—The pain which is due to the accompaning pleurisy is not uncommonly quite severe. It tends to prevent sleep, and by increasing the superficial character and rapidity of the respirations aggravates the dyspnœa and prevents the oxygenation of the blood. Either hot or cold applications are here beneficial, and the employment of cold has the special advantage, as we will see later, of controlling the pyrexia. Heat may be employed, either in the dry form, as hot cotton wadding, hot flannel cloths, or hot-water bag; or moist, as flaxseed poultices, and finally by means of cloths wrung out in hot water or turpentine stupes. Cold may be applied by means of ice-bags, compresses, or the local use of ether. The relief afforded by these methods is, however, apt to be transient, and if the pleuritic pain is severe local abstraction of blood by wet cups or leeches will often be found of benefit. If this fails, a hypodermic injection of morphine may be given at the seat of pain, or Dover's powder in doses of 5 grains may be administered every three or four hours. The employment of opiates for this condition

should, however, if possible, be avoided. Ringer[1] considers morphine injections to be rarely required unless the suffering is severe or persistent. An iced poultice, as suggested by Hare,[2] is both a neat and ready manner of applying cold for this purpose. The same author also advises a small blister applied near the painful spot or on the back near the spine. Niemeyer strongly advocates cold compresses renewed every five minutes; he says: "In almost all cases, even after a few hours, the patients assure me that they feel a material relief." Leeching, followed by hot fomentations, with the administration of sulphonal or chloral, may procure, according to Sturges and Coupland,[3] some hours of freedom from pain and induce refreshing sleep.

Cough may be an annoying symptom, especially in the first and third stages of pneumonia. When present to any greater extent than is compatible with the existing bronchitis, inhaling the spray from an ordinary steam atomizer is, as the author can testify from personal experience, of decided benefit; even keeping the air of the room moist by steam is helpful. Sturges and Coupland recommend the same means of procedure for cough as they employ for the relief of pain. Carbonate of ammonium, with minute doses of morphine ($\frac{1}{32}$ grain), is often of benefit. Stimulating expectorants should, however, be avoided unless considerable bronchial catarrh is present. Where expectoration is difficult from great viscidity of the sputum, alkalies are of service.[4]

Sleeplessness is usually due to either pain, cough, dyspnœa, or prostration, and if possible should be overcome by removing these causes rather than by the employment of narcotics. The measures and remedies suggested for the relief of pain or cough will then largely accomplish our object. Sleeplessness due to prostration is best treated by liquid nourishment given in small quantities frequently repeated, to which a small quantity of wine may be added, the wine being given not so much for its stimulating qualities as for its tonic action on the stomach and the resulting aid to digestion. Most English authors condemn the practice advocated by some of our best American writers and teachers of keeping the patient fully under the influence of opium to procure sleep, claiming that narcotism which causes prolonged sleep is unrefreshing and often followed by increased discomfort and dyspnœa. If we admit that sleeplessness is usually caused by the conditions above named, it certainly seems more rational to counteract these causes than to stupefy our patient with opium. If, however, these measures fail, chloral in one full dose guarded by digitalis, or morphine also given in one full dose, may be required

[1] *Handbook of Therapeutics*, 12th ed. p. 495.
[2] *Practical Therapeutics*, 2d ed. p. 320.
[3] *Pneumonia*, 2d ed. p. 409.
[4] Loomis, Pepper's *System of Med.*, p. 348.

Pyrexia.—Not uncommonly the pyrexia in pneumonia reaches such a height that the life of our patient is threatened, the danger coming more from the heart and train of nervous phenomena which the pyrexia induces than from the fever itself, although this has necessarily an injurious effect upon the organism. Undoubtedly, the safest and most reliable means of reducing this pyrexia or hyperpyrexia is by the external application of cold. It must, however, be borne in mind, as Liebermeister[1] has shown, that most is to be expected from cold in pneumonia when the area of lung affected is small. The value of antipyretic treatment is clearly shown by Jürgensen[2] at the Basle Clinic. Under the usual routine treatment from 1839 to 1866, in 652 cases the mortality was 25.2 per cent. From 1867 to 1871, antipyretic treatment in 230 cases, the mortality was 16.5 per cent. Fismer, comparing this same series of cases treated antipyretically with 230 patients treated by a non-antipyretic plan, shows a mortality which closely resembles the first. From 1858 to 1866, in 230 cases with non-antipyretic treatment the mortality was 26.1 per cent.; from 1867 to 1871 with antipyretic treatment the mortality was 16.5 per cent.

The objection to the cold bath—namely, that for a time at least extra work is thrown upon the heart by the contraction of the peripheral vessels due to the stimulus of cold—might seem at first to be a grave one. Practically, however, such is not the case. To counteract this, stimulants should always be given *before* and *after* the cold bath—before, for the reason just stated; after, because the temperature often continues to fall for twenty to thirty minutes after the bath has been discontinued, and great depression, or even collapse, has at times been threatened. This is well represented in a case of acute rheumatism complicated by pneumonia treated by Dr. Wilson Fox,[3] the temperature being reduced from 110° to 97.4°—*i. e.* 12.6°—in one and a half hours by a bath of forty-five minutes' duration. The patient having been removed from the bath when the temperature reached 103.6°, the temperature fell in the fifty minutes following her removal to 97.4°—*i. e.* 6.2°. External heat and brandy were sufficient to cause prompt reaction, and the patient recovered.

The temperature of the bath should be from 75° to 85° F.; it may, however, be necessary to lower this by the addition of ice or iced water. In Dr. Fox's case, for instance, the bath was reduced to a temperature of 63° F., and Jürgensen[4] has lowered the water of the bath even in children to 42.8° F. and 41° F. with good results. This reduction is

[1] *Handbook of Therapeutics*, vol. ii. p. 159.
[2] *Ziemssen's Cyclopædia*, vol. v. p. 161.
[3] *Treatment of Hyperpyrexia*, by Wilson Fox, p. 5.
[4] *Ziemssen's Cyclopædia*, vol. v. p. 163.

rarely necessary. During the bath the rectal temperature should be taken every five minutes. The duration of the bath depends upon the rapidity with which the pyrexia is lessened; usually it varies from seven to forty-five minutes. It is not often necessary to repeat this treatment more than twice or three times in twenty-four hours. In sthenic uncomplicated cases the patient should be placed in the bath when the fever reaches 103° F., and removed when the thermometer registers 100° F. In asthenic cases it is wiser to discontinue the bath when the patient's rectal temperature reaches 101° F. Under no circumstances should it be continued until the temperature reaches the normal point. In asthenic cases baths at a temperature of 77° F. to 78° F., administered for twenty to thirty minutes daily between four and seven A. M., together with the giving of quinine, has in the hands of Jürgensen produced excellent results. The cold bath has, notwithstanding its advocacy by many prominent American physicians and the lessened mortality following its use, never become popular in this country. This is probably due to the fact that it requires portable tubs and skilled attendants; like Brand's treatment of typhoid fever, it is more applicable to hospital than to private practice.

Compresses or cloths wrung out in iced water, renewed every five minutes and applied to the chest, especially upon the side where the consolidation exists, are, except when extensive bronchitis is present, among our best means for reducing pyrexia. They should be discontinued when the thermometer registers 101° or 100° F., as the temperature will often continue to fall after their removal. From a considerable experience with this method of applying cold the author can state that good results may confidently be expected from it. Heart-failure is not produced, if care be taken not to make the applications over the præcordial region; the nervous system is not depressed, but steadied; and diminished pain, with sleep, often follows its employment. The good effects are due, in the writer's opinion, not so much to any local action, as suggested by Niemeyer, but to the reduction of the pyrexia. The ice-bag as employed by Dr. D. B. Lees is an admirable manner of applying cold to the chest, and seems to act especially well with children, probably from the fact that it is easy to apply and covers in the young a large portion of the chest.

The use of the wet pack has been strongly urged by many competent observers, but it necessitates so much disturbance of the patient that while it may answer a useful purpose it is decidedly inferior to the cold bath or compresses. Before leaving the subject of cold applications it should be mentioned that reduction of pyrexia by baths, compresses, or pack should be employed with care in the weak and aged, as we are here more likely to meet with prostration and collapse during or following their use.

The majority of American physicians do not regard with favor the use of antipyretic drugs, fearing their well-known depressing action on the heart. Quinine in doses of 20 to 40 grains, repeated if necessary in two hours, has, however, the powerful indorsement of Loomis. Jürgensen gives it in the massive doses of 77 grains to an adult and 15 grains to a child under one year, and claims never to have seen any unfavorable results from such dosage. He advises these large quantities only after repeated cold baths have failed to do more than temporarily reduce the pyrexia. But as quinine in such large amounts is apt to cause vomiting, and the wished-for reduction in temperature does not occur until from four to seven hours after the administration, its use is hardly to be commended. Neither Bartholow nor Osler favors quinine as an antipyretic. Antipyrine, both on account of its sedative action on the nervous system and its well-known apyrexial properties, is advocated by J. C. Wilson.[1] The author has used antipyrine in 5-grain doses guarded by 3 grains of sulphate of quinine, repeated if necessary every half hour until three doses were administered, and has in a limited number of cases seemed to obtain the effects of the antipyretic without its usual depressing results.

Dyspnœa.—The dyspnœa which occurs in pneumonia, while in the main due to the large portion of pulmonary structure rendered useless by the inflammatory exudate, may be, and often is, aggravated by other causes. The pain of pleurisy by making the respirations shallow increases their frequency. Emphysema or cardiac dilatation if present adds greatly to the distress, and abdominal distension, from the presence of flatus or liquid, may increase the already existing shortness of breath. In cases in which the pleuritic stitch aggravates the dyspnœa, the treatment of this pain, as already outlined in a previous page, should be followed. If extreme dyspnœa, threatening asphyxia, coincides with irregular cardiac action, weak pulse, and decided blueness of lips and finger-tips, together with the physical signs of extensive pulmonary œdema and congestion, bleeding[2] from the arm to the extent of eight to twelve ounces will afford at least temporary relief and give an opportunity for the exhibition of stimulants. Turpentine stupes or mustard applied to the chest will often be found of benefit. Cold compresses are strongly urged by Niemeyer[3] for the relief of dyspnœa, and in the croupous pneumonia of children they are especially recommended by Ziemssen. Dry cups have in the hands of the writer often given marked relief. Ethyl iodide, 20 to 30 minims dropped on a handkerchief placed lightly over the mouth and inhaled, is strongly advocated by Bartholow; and strychnine, both on account

[1] *Medical News*, Philada., Dec. 20, 1890.
[2] Loomis, in Pepper's *System of Medicine*, p. 346.
[3] *Handbook of Practical Med.*, p. 185.

of its stimulating power upon the respiratory centre and its tonic action on the heart-muscle, is advised by Hare.[1]

Heart Failure.—As the chief danger of pneumonia lies in failure of the heart, all drugs or measures which tend to depress this organ should be as far as possible excluded from the treatment. Absolute rest and quiet in bed must be insisted upon, and the patient should be kept upon a light, nourishing, and easily-digested diet, given at frequent intervals. Heart failure in pneumonia, according to the observations of the author, occurs under two conditions: First, by a paralysis of the right heart, caused by the solidification in the lung, overdistension of the pulmonary artery and vessels, and passive congestion of the venous system, the formation of heart-clot, and the arrest of the heart in diastole. Secondly, a gradual failure of the heart as a whole, most apt to occur in cases in which the infection is intense, as shown by hyperpyrexia, marked nervous phenomena, great prostration, and a general adynamic condition. These two conditions can easily be distinguished, not only by their symptoms, but also by carefully studying the cardiac sounds. When paralysis of the right heart is threatened, we have, in addition to the signs of pulmonary and venous engorgement, a muffled first and poorly-accentuated second sound, heard over the area of the pulmonary valves. When the heart as a whole is failing, we have, in addition to the nervous phenomena, *all* the heart-sounds weakened. The treatment of both these conditions is in many respects the same. Alcoholic stimulants judiciously applied are undoubtedly the best means at our disposal for combating both these forms of cardiac failure. But alcohol must be given with discretion: the first sound of the heart is a much better indication for or against stimulation than the pulse. Its use must be governed by judgment, and it should not be given as a routine practice.

The pneumonia of drunkards and of the aged, when great prostration is present or collapse is threatened, is a condition in which stimulants are not only useful, but demanded. Many sthenic cases require little or no stimulation throughout the entire illness. Large quantities of alcoholic stimulants may, however, be necessary to ward off impending collapse, 20 ounces having been given during one night, by Dr. Wilson Fox, with marked benefit in a case in which collapse was threatened, following reduction of hyperpyrexia by the cold bath. When failure of the right heart is imminent, bleeding from the arm, 10 to 12 ounces, will often give marked temporary relief. Dr. Darrach[2] advocates the use of nitro-glycerin. This drug, or potassium or sodium nitrite, is also strongly urged by Andrew H. Smith,[3] who claims

[1] *Practical Therapeutics*, 2d ed. p. 535.

[2] *Trans. Philada. Coll. Phys.*, 3d Series, vol. x. p. 186.

[3] *American Journ. Med. Sciences*, Oct., 1890.

that in those cases in which the right heart is exhausted from overwork, caused by the accumulation of blood in the venous system, nitroglycerin, by its well-known action of dilating the blood-vessels, causes a more even distribution of the blood in the arteries and veins, and will, temporarily at least, be of benefit to the right heart. Dr. Smith claims excellent results from doses of 1 drop of a 1 per cent. solution, administered every fifteen to thirty minutes. The remedy is certainly worthy of extended trial, especially as much is claimed for it in a condition in which the physician often clearly perceives his own helplessness.

Digitalis in these cases, in my experience, does little or no good. Sturges and Copland have not found digitalis efficacious in removing dyspnœa, cyanosis, and other signs of auricular distension. Bleuler gave digitalis, ½ drachm of the powder daily, getting in some instances the toxic influence of the drug: his results were decidedly unfavorable. Digitalis is, however, in the writer's opinion, of decided benefit in those cases in which the heart as a whole is failing. Given in 5-drop doses every three or four hours, especially if combined with $\frac{1}{60}$ grain of strychnine sulphate four times a day, it will steady the heart, slow the pulse, change the character of the heart-sounds, and produce its well-known tonic action on the heart-muscle.

Diarrhœa.—Diarrhœa occasionally develops during pneumonia. If appearing early in the case, it is usually of a mild character, and is easily controlled by strict attention to diet and the internal administration of opium or astringents. Developing at the time of crisis, it will, as a rule, exhaust itself in a few days, and requires little or no treatment. In infants and young children vomiting and diarrhœa are not infrequent at the beginning of the attack, and in such cases special attention should be given to the diet; if nursing increases decidedly the dyspnœa, it may be wise to give the child, temporarily at least, peptonized milk, beef-juice, or beef peptonoids. Dover's powder in suitable doses or bicarbonate of sodium, with small doses of deodorized tincture of opium, will usually be all that is required. Low forms of pneumonia in the aged are occasionally accompanied by diarrhœa; astringents answer here the best purpose: opium must be used with caution.

Delirium.—Active delirium is rather unusual in uncomplicated pneumonia of adults; it is not uncommon in children. Delirium is not infrequently associated with disease of the kidneys or meningitis, and our treatment should under these conditions be directed to the meningeal or renal disease. A history of alcoholism can often be obtained in these cases. Absolute quiet, a darkened room, and cold applications to the head will suffice to relieve the milder cases. Persistent delirium will require stimulants in small quantities frequently

repeated, and a full dose of either chloral or morphine. In inebriates chloral, digitalis, and free stimulation have given the best results. Delirium in adynamic cases or in the aged demands prompt and free stimulation. Professor H. C. Wood[1] considers musk, 10 to 15 grains suspended in mucilage and given by rectal injection every six hours, to be very useful in these adynamic cases, especially if wild or muttering delirium be present. Opium must in these cases be given with caution.

Stimulants.—The question of stimulation is one on which a fair unanimity of opinion prevails. The necessity for the use of stimulants is often evident, especially in the aged, when great prostration exists. Stimulation should not be delayed until the vital powers are greatly depressed, and except in cases of sudden collapse it is wiser to begin with small quantities, gradually increasing the amount if the indications warrant. Hyperpyrexia is to be treated by stimulants only when other symptoms demand it. During convalescence it is often of service to counteract the resulting weakness. Alcohol, given either as brandy or whiskey, is usually the best stimulant, but if nausea or vomiting is present iced champagne may be preferable. When symptoms of indigestion are present, especially if the indications for stimulants are not marked, a light wine, as dry sherry, given with the nourishment acts not only as a mild stimulant, but also as an aid to digestion. Its efficiency under these circumstances is often increased by a dose of 5 to 7 grains of calomel, with 10 grains of bicarbonate of sodium given a few hours beforehand. Carbonate of ammonium has been given for the purpose of preventing heart-clot; its use has not, however, been followed by any great measure of success. Camphor, musk, and other so-called stimulants have their advocates, but cannot, in the writer's opinion, be depended upon with any degree of confidence.

Inhalations.—Inhalations have been employed with a fair degree of success in the treatment of pneumonia, and are of undoubted assistance in the treatment of dyspnœa, venous congestion, and sleeplessness. Oxygen, either pure or in combination, is the gas which is deservedly the most popular. In regard to inhalations, it must be borne in mind that all remedies employed are carried by the respired air to their destination, coming in contact with both healthy and diseased structures; therefore, all irritant inhalations are contraindicated. Full inspirations with the mouth wide open offer the best opportunity for their entrance. J. C. Wilson[2] employs a mixture of 1 part oxygen with 2 parts of nitrogen monoxide. Bartholow[3] claims antiseptic properties for iodide of ethyl, and that decided improvement in cough, bronchial irritation, and expectoration follows its use: the method of its administration is

[1] *Therapeutics*, 7th ed. p. 115. [2] *Medical News*, Philada., Dec. 20, 1890.
[3] *Amer. Journal Med. Sciences*, Nov., 1890.

given on a previous page. An equal mixture of chloroform vapor and atmospheric air is advised by Professor M. J. Oertel:[1] it has in his hands not only relieved pleuritic stitch, but also diminished the number and increased the fulness of the respirations.

Antiseptic Treatment.—The treatment of pneumonia by antiseptics—*i. e.* the specific treatment—has not been regarded with much favor by the medical profession. Benzoate of sodium, iodine, the salicylates, iodide of ethyl, and carbolic acid are especially recommended as antiseptics. Of these the results obtained from iodine are the most striking. The treatment of pneumonia antiseptically has, however, as yet not been conducted on a scale sufficiently large to warrant a positive opinion being expressed in regard to its usefulness. That numerous agents have the power to destroy pathogenic organisms is certain, but as yet in the treatment of pneumonia no means have been devised of bringing a sufficiently powerful germicide into such relationship with the infecting organisms as to abort, shorten, or mitigate the severity of the pneumonic process.

Antiphlogistic Treatment.—Tartar emetic in large doses as a part of the old antiphlogistic régime is to be avoided; it tends by depressing the heart to render it less able to endure the strain which usually falls upon this organ during the progress of pneumonia. Veratrum viride, although still advocated by many prominent English and American physicians, is to be avoided for the same reasons as tartar emetic. Its use is, however, free from the objection of causing the intense nausea and vomiting (unless administered in very large quantities) which follow the giving of tartar emetic in doses sufficient to cause a decided reduction in the circulation. It is comparatively free from danger, and may be used when in the early stage of sthenic cases marked arterial excitement is present. Its utility ceases when exudation has taken place. Aconite is open to the same objections as veratrum viride; its use is also not unattended with danger, since it is a powerful cardiac depressant. The writer thoroughly agrees with Loomis and J. C. Wilson, who claim that its depressing action on the heart should prevent its employment in the early stage of even sthenic pneumonia.

Treatment of Convalescence.—Convalescence is, as has been previously stated, usually complete and rapid. Tonics, such as iron and quinine, with a supportive and mildly stimulating plan of treatment, will in the majority of cases be all that is required to complete a cure. In asthenic cases and in the aged, prostration, collapse, and subnormal temperature may follow the crisis. These untoward symptoms are, however, unusual, especially in cases in which a supportive and stimulating plan of treatment has been followed.

[1] *Von Ziemssen's Handbook of General Therapeutics*, p. 328.

Asthenic cases and the prostration of the aged are to be met by prompt stimulation, concentrated nourishment, and tonics. Collapse and subnormal temperature demand, in addition to the above, the application of external heat and the hypodermic use of whiskey or ether. Resolution may not be rapidly established, and impaired percussion resonance, with broncho-vesicular breathing and subcrepitant and crepitant râles, may remain at the seat of former consolidation. These physical signs usually disappear in from four to six weeks under proper hygienic, dietetic, and tonic treatment. Flying blisters, iodine locally, or the iodides internally, especially the iodide of ammonium, will tend to hasten clearing up of the lung. If fever persists, resolution be delayed, and improvement in the general health is not noted, tubercular disease should be thought of, and patients in this condition should be protected as far as possible from tubercular infection. When wasting and night-sweats are present with the above symptoms, tubercular phthisis has probably developed and treatment appropriate to that condition should be instituted.

Venesection.—The subject of bloodletting has already been referred to incidentally in the previous pages. Venesection has, however, occupied such a prominent place in the history of pneumonia that a discussion of its treatment would be incomplete were bloodletting not carefully considered. Bleeding as a routine plan of treatment—that is, bleeding for pneumonia—is, in the light of modern pathology and the existing belief of its causation, not only useless, but harmful. There is no doubt that the pendulum of medical opinion in regard to bloodletting has swung from one extreme to the other, and that the almost universal condemnation of bleeding at the present day will be shortly corrected. Venesection is, moreover, as Flint[1] observes, especially applicable to the treatment of inflammation affecting the pulmonary organs in consequence of the close relationship between the heart and lungs. The chief advantage of bloodletting is that the results are rapidly obtained. At the present day we bleed only to gain time or to combat certain conditions, exactly as we might give a hypodermic injection of morphine to relieve pain after having employed milder means without success. The improvement which follows its use is usually of short duration.

In sthenic cases when the symptoms of acute pulmonary congestion are intense—*i. e.* dyspnœa threatening asphyxia, venous congestion, and hard, incompressible pulse—*early* bleeding from the arm, 8 to 12 ounces, often gives relief and seems to exert a favorable impression on the progress of the case. In the second stage bleeding is admissible only when asphyxia is threatened from venous congestion, and the abstraction of 8 to 12 ounces of blood affords time for the exhibition

[1] *Practice of Medicine.*

of stimulants. Extreme dyspnœa, however, when accompanied by great prostration, contraindicates venesection. It is not without danger in the aged when prostration exists, and if kidney disease is present, bleeding increases the chance of an unfavorable termination. Protracted convalescence often follows its use. The indications are high fever, full, resisting pulse, urgent dyspnœa, and robust constitution; the contraindications are moderate fever, rapid and weak pulse, feeble constitution, and old age. Pneumonia as a complication of the continued fevers is to be treated by supportive measures, not by bleeding. Venesection is rarely if ever admissible in young children, even in the early stage.

Abortive Treatment.—The so-called abortive treatment of pneumonia is received, and justly so, with little faith by the medical profession. There is nevertheless considerable evidence to prove that one full dose, 10 grains, of calomel, or active catharsis by salines, if employed soon after the initial chill, temporarily improves the general condition of the patient, and possibly even exerts a favorable impression on the subsequent course of the disease. Early in the disease quinine, given in large doses when hyperpyrexia is present, has seemed to the author to be of more than temporary benefit. The writer has had no experience with the hypodermic use of pilocarpine in this connection, but would hesitate to employ it lest depression should follow its use.

Complications.—The many and varied complications of pneumonia cannot be discussed in this article. Two conditions will be briefly considered—the secondary extension of the pneumonic process, and the development of solidification in the opposite lung. These complications are of the utmost gravity, and positively demand a supportive and actively stimulative line of treatment. The treatment of other complications will be determined by the fact as to whether it is the pneumonia or the coexisting disease which is threatening the life of the patient. When the danger lies upon the side of the coexisting affection, the treatment should be directed to removing or counteracting that condition. If the pneumonia, notwithstanding the complication, is paramount, the following of a symptomatic method will give the best results. The consideration of the sequelæ of pneumonia—phthisis, abscess, and gangrene—does not come within the scope of this paper, and accordingly they will not be noticed.

Mortality Statistics.—It is not difficult to understand the unreliabilty of most mortality statistics as regards any special line of treatment in pneumonia, if we remember, on the one hand, the many phases of the disease, and the fact that it is self-limited and will often end in recovery without treatment; on the other, that in many instances

the lesions found post-mortem are incompatible with life, and that Rasori and his pupils have proven, by removing ten pounds of blood from a single patient, that some cases will recover notwithstanding the means employed for their relief. The statistics of any treatment to be of value should embrace an accurate description of the condition of the patient before, during, and after its employment.

The danger in drawing conclusions from limited statistics is clearly shown by Osler[1] in the following table, collected from the reports of the Pennsylvania Hospital of Philadelphia:

Years.			Years.		
1845–46–47—mortality	16	per cent.	1848–49–50—mortality	37.9	per cent.
1855–56–57— "	25.4	"	1858–59–60— "	21.2	"
1865–66–67— "	24.1	"	1868–69–70— "	22.8	"
1875–76–77— "	39.2	"	1878–79–80— "	32.7	"
1885–86–87— "	36.1	"			

If one considers only the table on the left, it might easily be supposed that, as Dr. Hartshorne declares, under the older plans of treatment the mortality was less than under the present expectant method. But a glance at the figures in the right-hand column immediately disproves this, the mortality of 37.9 per cent. in 1848–49–50 under the older methods being almost as great as that of any period cited.

Statistics, however, which relate only to a certain condition, as asthenia, treated by certain means, as alcohol or digitalis, or to a definite symptom, as pyrexia, treated by cold sponging or antipyretic drugs, are undoubtedly of great value. By this method it is possible by comparison to judge at least approximately of the relative merits of the means employed.

CATARRHAL PNEUMONIA.

It is evidently impossible to formulate any exact rules for the treatment of catarrhal, lobular, or broncho-pneumonia, as the disease varies greatly in onset, symptoms, course, and duration. The condition is one of local inflammation, not a general or systemic disease. It is usually bilateral, and is always accompanied by atelectasis of greater or less extent, this collapse being mainly produced by the existing bronchitis obstructing the bronchioles, and the inherent elasticity of the air-vesicles. The inflammatory process cannot be checked by an abortive plan of treatment, and, as in croupous pneumonia the best results are found to follow an expectant symptomatic method, so

[1] *Trans. Philada. Coll. Phys.*, 3d Series, vol. x. p. 188.

in catarrhal pneumonia to nourish the patient, remove all source of external irritation and worry, and promptly treat all dangerous conditions or symptoms as they arise is the method which experience proves most worthy of adoption.

The best criterions of the patient's condition from day to day are undoubtedly, as Sturges and Coupland[1] aver, the pulse, prominence of attending symptoms, as vomiting, diarrhœa, and wasting, the rapidity of respiration, and the cough. The physical signs and temperature are often misleading.

Since broncho-pneumonia is a local disease due to a pre-existing local cause, it is of the first importance to remove this cause. In considering the prophylactic treatment of this disease, and remembering its connection with bronchitis, it becomes of the utmost importance to study carefully the different conditions, either local or systemic, under which catarrhal pneumonia develops.

Recurrent attacks of bronchitis predispose to broncho-pneumonia. It is common after all infectious diseases with which bronchitis is associated, such as whooping cough, measles, diphtheria, influenza, scarlet fever, and variola; while the inhalation of irritating gases, as well as the presence in the bronchi of foreign bodies, undoubtedly favors its development. Among the chronic diseases which stand in a causative relationship are rickets, syphilis, and scrofula.

Bronchitis in children under three years of age, and in the aged, especially if occurring under bad hygienic or dietetic conditions, must be carefully watched, lest catarrhal pneumonia develop. Bartels insists especially on these factors as causative.

When we consider the fact that in catarrhal pneumonia the death-rate is higher than in the croupous variety, the importance of both prophylactic measures and prompt treatment after the disease has developed is evident.

Many varieties and forms of catarrhal pneumonia have been described by observers. The division into acute and chronic is, however, sufficient for our purposes. The symptomatology and physical signs may vary much in these two forms, the slow course, involvement of large area of lung-tissue, and moderate febrile reaction in the chronic variety being in marked contrast to the rapid and superficial respiration, high and irregular fever, and great restlessness of the acute form. These differences are present both in infant and adult life. The acute form runs its course usually in from two to four weeks; chronic catarrhal pneumonia may last for months. In the treatment of this affection it must be remembered that the danger is in inverse proportion to the duration of the attack and in direct proportion to the physical condition of the patient and the extent of lung involved.

[1] *Pneumonia*, p. 247.

The prophylactic treatment consists mainly in good hygienic surroundings and appropriate diet; the avoidance of all unnecessary exposure to wet, damp, and draughts; a daily bath, and the wearing, especially in children, of close-fitting woollen under-clothing. When bronchitis has developed the patient should remain in a well-ventilated room, the temperature being from 68°–72° F., and the air kept moistened by steam. If the bronchial catarrh is mild at the onset, Dover's powder, a warm bath, and a saline with 12 grains of sulphate of quinine for an adult in twenty-four hours, will usually be all the treatment required. If the foregoing means are not successful, mild diuretics and diaphoretics, inhalation of steam, the application of dry cups, and 5 grains of chloride of ammonium every three hours will usually suffice.

All that the term "good nursing" in its broadest sense implies aids materially in producing rapid convalescence. The patient should be made comfortable in bed, be bathed every day, and, if the sufferer be a child, not frightened, but as far as possible amused and his confidence gained. If the latter is not accomplished, little aid is obtained from the results of physical examination. Rest in bed is imperative, and during the entire course of the disease the patient's position should be frequently changed, as hypostatic congestion, œdema, and collapse are thus often prevented.

When catarrhal pneumonia has developed, our treatment is mainly directed to supporting the strength of the patient, promoting expansion of the lungs, and controlling the pyrexia. At the beginning of the attack calomel in fractional doses with bicarbonate of sodium is often useful, especially in children, in whom nausea and vomiting are apt to be present. Quinine in full doses is undoubtedly a remedy of great value in both the acute and chronic forms of the disease. It is of special service in the young by controlling the pyrexia and pulse, sustaining the system, and possibly limiting the extension of the pneumonic process. Chloride of ammonium is of undoubted benefit, especially after the acute stages of the disease have passed. If asphyxia is threatened from an accumulation of bronchial secretion, an emetic often gives prompt relief.

As death in catarrhal pneumonia, especially in children and the aged, is not infrequently due to asthenia, stimulants are often required from the onset of the attack. The bowels should be moved every day, gentle laxatives, as compound liquorice powder or citrate of magnesia, being useful for this purpose. Local counter-irritation with mustard, tincture of iodine, or a mildly irritating liniment is of benefit.

The room should be large, well ventilated, and the light regulated according to the wishes of the patient. The temperature should range from 68° to 72° F., and the air be moistened by the vapor from a

steam atomizer. The clothing should be adapted to the season, and care be taken that the patient is not subjected to draughts. A light cotton jacket protects the chest from changes in temperature and promotes diaphoresis; it is especially of benefit in the case of children. Throughout the disease light, nourishing, and easily-digested food, such as milk, broths, beef-tea, and beef peptonoids, should be given in small quantities frequently repeated. While an abundance of nourishment is called for, the patient should not be overfed, lest the digestive powers be overtaxed, vomiting result, and the general asthenic condition be increased.

If urgent dyspnœa exists in a very young child, the little patient is no longer able to nurse properly, and the effort to do so may, by increasing the already-existing shortness of breath, provoke vomiting. Cow's milk with cream and barley-water and a few grains of sugar of milk may be given with advantage under these circumstances.

The treatment of the bronchitis, by reason of its close connection with catarrhal pneumonia and collapse, is of decided importance. When in the first stage of the disease the cough is excessive, out of proportion to the amount of coexisting bronchitis, and tends by inducing nausea, vomiting, and loss of sleep to diminish the vital forces of the patient, opium in combination with ammonium carbonate, in doses suited to the age and condition of the patient, should be employed. When, however, the inflammatory process in the lung has fully developed, opiates must be used with caution, lest by obtunding sensibility reflex cough should be checked, and, the secretions collecting in the bronchial tubes, the already existing dyspnœa be aggravated. Many authors, among whom may be mentioned Loomis,[1] claim that opium should under no consideration be given. Certainly after consolidation is completely established opiates by checking cough favor pulmonary collapse. Their employment in the early stage of a bronchopneumonia to relieve the excess of cough has, however, in the hands of the writer been followed by good results.

The chloride of ammonium, combined with syrup of senega or syrup of squill, favors expectoration and tends to prevent collapse of the lung-structure. It may occasionally be necessary, owing to the abundance and viscid condition of the collected mucus in the bronchial tubes, to administer an emetic. The well-known combination of alum and ipecac here answers a useful purpose, and is, in the opinion of the writer, followed by less depression than either sulphate of zinc or the hypodermic injection of apomorphine. The latter when used is given in doses of $\frac{1}{12}$ grain to an adult, and repeated if necessary in twenty to thirty minutes. Emetics must, however, be used with care in all asthenic cases, as marked depression or collapse may follow their

[1] *Practice of Medicine*, p. 108.

employment. When excessive bronchial secretion with suppressed or feeble cough is present, carbonate of ammonium with syrup of senega is often of benefit.

The inhalation of steam, by increasing the secretion of the bronchial mucous membrane and diminishing the viscid character of the sputum, will facilitate expectoration and temporarily relieve the dyspnœa. In the later stages, as well as in the chronic form of the disease, oil of turpentine as a stimulating expectorant seems by common consent to be the remedy which is most often followed by good results. It may be given in 5-drop doses every four hours.

Inhalations of oxygen often give marked relief when symptoms of asphyxia are present. Strychnine, both on account of its stimulating action upon the respiratory centre and its tonic effect upon the muscles of respiration, is also beneficial. Jürgensen[1] recommends highly in this connection the use of baths at a temperature of 77°–86° F., the patient remaining in the bath from twenty to thirty minutes. After he is placed in the bath 10 to 20 quarts of water are poured over him from a moderate height. The affusion must be rapid, and the neck, back, and chest should especially be douched. The water used may be reduced in temperature to a few degrees above the freezing-point. The same author also claims excellent results from the use of a stream of water directed against the back of the head over the region of the medulla oblongata. Deep inspirations with increased strength of cough are claimed to be induced by this procedure, even when marked symptoms of carbonic-acid poisoning are present.

Notwithstanding the good results claimed to follow the employment of the bath and douche in dyspnœa, it has never been generally adopted as a method of practice. If, however, its further use confirms the claims of Jürgensen, Bartels, and others, it will be of undoubted aid in the treatment of a dangerous condition. It must not be forgotten that stimulants should always be administered before and after the bath. The application of leeches in children and the employment of venesection in adults will often, as in croupous pneumonia, be followed by marked relief. Inhalations of steam and thorough dry cupping of the chest are also useful adjuncts to our treatment of rapid and superficial breathing.

During the course of a catarrhal pneumonia the state of the circulation varies greatly. The pulse, as a rule, is rapid even during the remission of fever; in children a pulse of 160 to 200 beats per minute is not uncommon. A small and compressible pulse is always an omen of danger. The muscular structure of the heart, while not suffering to the same extent as in croupous pneumonia, is still to some extent liable to fatty and granular change. Failure of the right side

[1] *Ziemssen's Cyclopædia*, p. 231.

of the heart is threatened when atelectasis is present in a marked degree. Undoubtedly the best means we possess to counteract heart failure in all stages of the disease, no matter what its cause, are bold stimulation, proper food, and quinine given in tonic doses. As regards the use of stimulants, they should be commenced early, and given in sufficiently large quantities to overcome the failure of the vital forces which often develops early in the disease. The rapid pulse, and in asthenic cases its weak and irregular action, and the tendency to degeneration of the heart-muscle, are conditions in which whiskey and brandy are especially useful. When failure of the right heart is threatened, prompt stimulation offers, in the writer's opinion, the only hope to the patient. The subcutaneous injection of 15 to 20 minims of ether, repeated three or four times daily, has undoubted power to increase the strength and volume of the pulse and diminish the number of respirations. In the adynamic form of catarrhal pneumonia ether is also of benefit.

Young infants may be given 10 to 20 drops of whiskey every three or four hours, and the quantity should be gradually increased if the condition of the pulse, respiration, or dyspnœa demands it. Children indeed often take large amounts with decided benefit. The quantity to administer must be determined by the necessities of each case. Alcoholic stimulation is also useful when failure of respiration is present, and is a valuable adjunct to treatment when marked nervous phenomena exist. Champagne is often beneficial in adults, especially if nausea and vomiting are present; children do not take it well.

Tonics and stimulants are to be resorted to in cases in which debility is manifest or when resolution is delayed, even if the fever has declined or if evidence of a typhoid state develops. Under these conditions the vital forces may by nourishment, alcohol, and tonics be sustained and strengthened, and time gained for the breaking down, absorption, and expectoration of the inflammatory exudate. Quinine in doses suited to the age of the patient is here the best tonic.

In that form of catarrhal pneumonia which is due to passive congestion or hypostasis, and in which debility plays an important rôle as a causative factor, frequent changing of the position is of benefit and quinine and alcohol demanded. According to Bartholow,[1] turpentine is also a most useful stimulant when the vital powers are depressed and the peripheral circulation is feeble. No attempt should be made to lower the temperature, either by drugs or the external application of cold, without the previous administration of either whiskey or brandy.

The treatment of the fever in catarrhal pneumonia, owing to its remittent character, does not often demand those vigorous measures which are called for in the croupous form of the disease. Sulphate

[1] *Materia Medica and Therapeutics*, 6th ed. p. 722.

of quinine has decided power in such cases, and while the fever persists may be given in full doses. Rapmund[1] recommends it highly in the treatment of pyrexia in lobular pneumonia. If the nervous phenomena are not marked and only moderate dyspnœa be present, quinine in decided doses or 5 grains of antipyrine, guarded by 3 grains of quinine, will often be of marked benefit. Antipyrine, according to Pribram,[2] positively diminishes the frequency of the respirations. It seems to act especially well in children. If these means fail, external applications of cold, either by cold bath, compresses, or cold douche, as advised by Jürgensen, to which special attention has been called upon a previous page, are, if properly carried out, undoubtedly the best means of combating this dreaded symptom.

It seems strange that American physicians, who are usually so prompt in giving all therapeutic measures a thorough and complete trial, should have so largely neglected, and even condemned without adequate experience, these measures of reducing pyrexia. Collapse has undoubtedly been caused by the incautious use of cold, especially in feeble children, but with care and the giving of stimulants, which in the writer's opinion is very important, it is almost always possible to prevent it. The ice-bag, as advised by Dr. D. B. Lees,[3] seems to be especially useful in the broncho-pneumonia of children. Goodhart strongly recommends its use. Continued high temperature demands, according to Bartholow,[4] the use of quinine and digitalis. Five grains of quinine and $\frac{1}{4}$ grain of digitalis are advised three times a day for a child two years of age.

Various nervous symptoms, as headache, restlessness, drowsiness, delirium, or convulsions, are not uncommon in the early stages, especially in children. Careful nursing, soothing words, and a familiar face at the bedside will often suffice in the milder cases. If in addition to the nervous phenomena high fever is present, either a sponge bath, the temperature of the water being from 72° to 76° F., or the application of cold compresses to the head, will often relieve the symptoms to a remarkable degree and be followed by refreshing sleep.

It must not be forgotten that in order to obtain the full benefit of cold affusions to the head the hair must be kept thoroughly wet, otherwise the head is, as it were, protected by a shield and the full benefit from the wet compresses is not obtained.

Chloral given by the rectum in doses of 3 grains to a child three years of age, or a combination of chloral and bromide, will, as a rule, promptly control convulsions and lessen delirium. If the heart's action is feeble or depressed, it is well to guard the use of chloral with alcoholic stimulants. Musk suspended in mucilage and given by rec-

[1] *Deutsche Klinik*, 1874, p. 51.
[2] *Prager. med. Wochenschrift*, 1884.
[3] *Lancet*, 1889, ii. p. 890.
[4] *Practice of Medicine*, p. 349.

tal injection is considered a very useful remedy by H. C. Wood in adynamic pneumonia when wild or muttering delirium is present. When the delirium is extremely active and restless, Pepper[1] advocates the hypodermic use of hyoscyamine in doses of $\frac{1}{80}$ to $\frac{1}{100}$ grain for an adult. Opium should not, in the opinion of the writer, be used to control the nervous symptoms, as in the doses required for this purpose sensibility is so far blunted that cough is lessened to a dangerous degree, and the tendency to dyspnœa with asphyxia increased.

Before considering the means to be employed to overcome the condition of pulmonary collapse, it is necessary to understand the causes operating to produce this condition. As is insisted upon by Bartels, collapse is especially liable to develop in those parts of the lung which under normal conditions display the least motion—that is, the lower and posterior portions. The diminution of the calibre of the bronchi, due to the inflamed condition of its lining membrane, and the failure of the superficial respirations of the patient to expand the lungs thoroughly, do not allow the inherent elasticity of the air-cells to assert itself, and the capacity of the alveoli diminishes. The accumulation of mucus and the partly occluded condition of the bronchi cut off the entrance of air to a certain portion of pulmonary tissue, and the small amount of air which remains disappearing, partly through the violent expiratory efforts of cough and partly by pressure, collapse takes place. It is therefore evident that asthenic conditions by favoring the accumulation of mucus in the bronchi, an immovable decubitus by increasing the tendency to hypostatic congestion and œdema, and high fever by increasing the rapidity and superficial character of the respirations, predispose to atelectasis.

Remembering, then, the conditions and causes upon which collapse depends, its treatment becomes evident. The frequent changing of the patient's position, with the application of dry cups, will clearly be of benefit in counteracting the collapse due to hypostatic congestion and œdema. Strychnine will be found useful when failure of the respiration is present, and the preparations of ammonium, with perhaps the cautious use of emetics, will be found most serviceable in removing the accumulations of thick, viscid mucus. The external application of cold by the bath, compresses, or sponging will control the fever, and the use of a stream of water directed against the back of the head, as recommended by Jürgensen, will be of benefit by diminishing the rapidity and increasing the fulness of the respirations.

One of the most important duties of the physician in the management of catarrhal pneumonia is the prevention of any gastro-intestinal disorder, and its treatment should it occur. The ability to take and digest nourishment in suitable amounts aids materially in sustaining

[1] *System of Medicine*, p. 372.

the vital forces, in preventing heart and respiratory failure, and in the avoidance of collapse. For the relief of the nausea and vomiting which are frequently present early in the disease the patient should be kept at absolute rest; iced carbonated waters, as plain soda-water, or in adults iced champagne, should be administered; small pellets of ice allowed to dissolve in the mouth; a mild mustard poultice applied to the epigastrium; and calomel in fractional doses, with 1 to 2 grains of bicarbonate of sodium, should be dropped on the tongue every two hours. The nourishment may consist of beef-juice, beef peptonoids, peptonized milk, or milk and lime-water. In severe cases it may even be necessary for twelve or twenty-four hours to stop all nourishment by the mouth and give nutrient enemata. The vomiting which accompanies the effort of nursing when dyspnœa is present in children has been referred to on a previous page. Diarrhœa when present is best treated by astringents.

The treatment of collapse must be prompt and decided. The hypodermic use of whiskey or brandy, with the external application of heat, often exerts a favorable impression on the pulse. Stimulating applications to the chest by mustard poultices or by liniments excite deeper and fuller respirations, and the alternate hot and cold douche often aids materially in arousing the patient, stimulating the cough, and improving the character of the breathing. The collapse which occasionally follows cold applications is best treated by enemata of whiskey and external applications of heat. In conditions of profound collapse remarkable results have been reported from the subcutaneous injection of ether.

Catarrhal pneumonia is usually followed by marked debility, and recovery takes place slowly. During convalescence careful nursing is necessary to prevent relapses, slight exposure often being sufficient to produce a return of the bronchitis, with a resulting broncho-pneumonia, and possibly the development of phthisis, especially in those who present a tubercular family history. Counter-irritation by tincture of iodine, dry cups, or a few small blisters, with the internal administration of ammonium iodide, will be of service in promoting resolution and absorption. During this period quinine, iron, and alcoholic stimulants will be found most useful, tending by improving the general condition to shorten convalescence. If in those cases in which the inflammatory process has pursued a subacute course convalescence is retarded and emaciation is marked, iron, cod-liver oil, the hypophosphites, and free stimulation are indicated. In all subacute and chronic cases the nutrition of the patient is of the first importance. Emetics during convalescence can only do harm by disturbing digestion. Much good is derived from the administration of oil of turpentine, eucalyptol, and copaiba at this stage of the disease. After convalescence

is established a change of residence to a high dry climate by the expansion and unfolding of the lungs resulting from the respiring of rarefied air will tend to hasten the cure.

The most frequent complications of catarrhal pneumonia are bronchitis, laryngitis, and pleuritis, which are really parts of the pneumonitic process, and are to be treated only when they assume such a degree of importance as to necessitate their control. The most important of the sequelæ is tubercular phthisis. As has been previously pointed out, it is especially liable to develop in those cases of subacute and chronic broncho-pneumonia in which a tendency to tuberculosis exists. Emphysema, and less often gangrene of the lung and pneumothorax, have been noted as sequelæ. The treatment of the complications and sequelæ does not, however, come within the scope of this article. The same broad rule applies to their treatment as exists in the croupous form of the disease. Only those complications or sequelæ which from their gravity are militating against the recovery of the patient should be treated.

Unless to meet some special indication, poultices are seldom useful. It is difficult in their frequent removal to avoid exposure of the chest; they fatigue the patient by their weight; and the restlessness of children renders it almost impossible to keep them in position. The ordinary cotton jacket covered with oiled silk is a much better and more comfortable protective. Counter-irritation with dry cups, tincture of iodine, mild mustard poultices, or turpentine stupes can, if the jacket is worn, be applied with facility to any portion of the chest. In connection with the poultices, mustard foot-baths may also be employed. The action of the skin may be increased and restlessness relieved by tepid sponge-baths, followed by friction. At the onset of the attack a large mustard plaster to the chest, allowed to redden the skin, has in a few cases seemed to the writer to be of decided advantage, while the tincture of iodine or an occasional blister is most useful during the stage of resolution. The pleuritic stitch can often be relieved by the application of hot flaxseed or linseed poultices.

Large blisters should never be employed. Venesection is rarely admissible; by reducing the vital forces of the patient and lessening the strength of the respiratory muscles it increases the tendency to pulmonary collapse. The application of leeches to the chest, with the giving of stimulants, is, however, strongly advocated[1] when extreme dyspnœa with shallow, ineffectual respirations is present, tending to pulmonary engorgement and collapse.

Inhalations do not play an important part in the treatment of catarrhal pneumonia. Von Ziemssen advises the inhaling of equal parts of chloroform vapor and atmospheric air, stopping short of com-

[1] Sturges and Copland, *Pneumonia*, p. 253.

plete narcosis, in cases in which considerable portions of lung-tissue are rendered useless by inflammation or œdema. Under its use respiration becomes deeper, its frequency is diminished, and cyanosis disappears. The inhaling of turpentine vapor is suggested by Bartholow. Oxygen, however, is the gas most frequently employed with advantage in such cases, since the interference with normal respiration indicates its employment.

DISEASES OF THE PLEURA.

By RUDOLPH MATAS, M. D.

INFLAMMATORY DISEASES OF THE PLEURA.

Pleuritis.

General considerations.

The word "pleuritis" or "pleurisy" is a generic term which signifies an inflammation of the pleura, and as such is susceptible of subdivision into species according to the exciting causes, the particular areas involved, and the various results which follow. From the etiological standpoint we thus classify pleurisy into two fundamental divisions: 1st, Primary (the so-called *pleuritis a frigore*): 2d, Secondary: *a*, pleurisies by propagation or extension—viz. traumatic, or from pulmonary (meta-pneumonic pleurisies) or pericardial lesions, etc.; *b*, the infectious pleurisies, in which the serous inflammation is but a local expression, a secondary manifestation, of a general constitutional condition—viz. the tubercular, rheumatic, exanthematic, uræmic, typhoidal, syphilitic, and septic pleurisies. The topographical conditions also suggest other distinct varieties—*e. g.* the partial and complete pleurisy, the diaphragmatic, interlobar, and mediastinal pleurisies. The pathological sequences of pleural inflammation also vary, and in consequence we have the typical plastic or "dry," the sero-fibrinous, the purulent, and hæmorrhagic pleurisies.

Of great therapeutic importance is the clinical division of pleurisies according to the intensity or course of the inflammatory process—viz. hyperacute (*pleuritis acutissima* Fräntzel), acute, subacute, chronic, and latent. While these divisions cannot be classed as varieties of pleurisy, since they may constitute a mere phase of any of the preceding true varieties, they are nevertheless all important in deciding the therapeutic attitude of the practitioner.

While the aim of modern research has been directed mainly toward the discovery of the specific pathogenic agents in the production of pleural inflammation, especially since the results of recent bacteriological investigations have proved so fruitful in defining the pathogenesis as well as indicating the therapeusis of the purulent types of this affection, it must still be admitted that the division of pleural inflammations

by their etiology is at present of greater theoretical interest than practical value to the clinician.[1] To the practitioner the degree of intensity of the initial phenomena, and the character of the exuded products resulting from this inflammation, and the condition of the compressed lung, together with a knowledge of the complicating conditions, must still remain the elements which profoundly affect his line of treatment, no matter what the presumed or known pathogenic factor may be.

Of prime importance in the treatment of this condition is the appreciation of the general fact that pleurisy is simply an inflammation of a serous membrane, and that as such it must react to irritants in a manner peculiar and common to all serous membranes. This reaction, which is illustrated as well in the phlegmasiæ of the other serosæ—the peritoneum, pericardium, arachnoid, tunica vaginalis, etc.—resolves itself essentially into an invariable tendency to hyperæmia, followed by exudation and proliferation, which may end in either adhesion of opposed surfaces or in a sero-fibrinous, sero-purulent, or hæmorrhagic transudation. These being the general characteristics of serous inflammation, the treatment of pleurisy must be based on the general therapeutics of serous inflammation *plus* those special modifications called for by the anatomical and physiological relations of this particular serosa.

[1] In a recent and most representative discussion on the etiology and treatment of acute pleurisy at the Third Congress of Italian Physicians, held in Rome Oct. 20–23, 1890, Professor Patella of Perrugia, who led the debate, summarized the present status of the question: "At present we know that there are pleurisies of infectious microbial origin. But (primary idiopathic) sero-fibrinous pleurisy is still regarded as due to a rheumatic causation, and yet we cannot well explain its pathogenesis without appealing to some other agency than "catching cold." It is probable that cold only prepares the soil for microbic infection by modifying in some manner the circulation in the lymphatics and other vessels. But how do the pathogenic germs find their way into the pleura? This is a question which, I must admit, is difficult to answer. Nevertheless, Fränkel has demonstrated that the germ of purulent pleurisy (the encapsulated micrococcus pneumoniæ) is found in the tonsils, whence by following a lymphatic route it may easily find its way to the pleuræ. We might therefore admit the practicability of the same route as an avenue of infection in simple sero-fibrinous pleurisy. . . . . Finally, I believe that, as far as the etiology of primary pleurisies is concerned, we may at the present time establish the following conclusions:

"1st. There are sero-fibrinous pleurisies which are due to the encapsulated micrococcus of Fränkel.

"2d. There are others, in which the effusion is very abundant, which are of exclusively tubercular origin.

"3d. In many tubercular individuals pleurisy may assume a simple non-tubercular type.

"4th. There are pleurisies of chemical origin which are still obscure and insufficiently studied.

"5th. it is more in the province of clinical medicine than in the power of bacteriological research to determine the nature and causes of primitive pleurisies.

"6th. As to the pleurisies which are developed secondarily to an acute pulmonary affection—meta-pneumonic pleurisies, for instance—their etiology is evidently that of the pneumonia, and their prognosis is in a general way more favorable than that of the primary pleurisies." (*La Semaine Médicale*, Oct. 29, 1890.)

While this consideration is paramount in the treatment of pleurisy, we should not under-estimate the great importance of a proper recognition of the underlying constitutional condition, whether pathogenic or associated, as a proper appreciation of this must necessarily modify the therapeutic efforts made toward effecting a control of the local condition.

In a contribution of this character, in which the study of the disease is entirely subordinated to its therapeutic application, it is impossible to dwell upon the details of the etiology, pathology, and symptomatology of each one of the varieties of pleurisy: it is essential, however, that we should know the natural history of the morbid process in general, the nature or character of the abnormal products created by this process, and which it is the object of our therapeutic effort to prevent or remove, and the means by which Nature, unaided, attempts to effect their removal, so that by a better knowledge of these facts we may aid her in the most rational and physiological manner.

Let us rapidly survey the anatomical and physiological conditions. Since the important and historic researches of Recklinghausen, Axel-Key, Retzius, Klein, and others it has become an established fact that the pleuræ, like the other serosæ, are nothing less than large lymph-spaces communicating directly through large orifices (stomata) with a vast subpleural lymphatic plexus. This plexus is intimately interwoven with the arterio-venous capillary plexus, and is unequally distributed under the parietal pleura. The lymphatics in the costal pleura are arranged in two layers: a superficial plexus, which is separated from the pleural cavity by the mere thinness of the epithelial layer, and is arranged into a canalicular system similar to that described by Auerbach in the muscular tissues of the intestines; the deeper lymphatic set is separated from the preceding by the subpleural connective tissue proper, and is more intimately related to the intercostal muscles. According to Dybkowsky, the lymphatic plexuses are only found in the intercostal spaces; they are absent on the surfaces of the ribs. From this anatomical arrangement it is plain that the respiratory movements of the thorax and of the lung must have a remarkable influence upon the absorbent functions of these vessels—a conclusion that has been clearly demonstrated by Dybkowsky's classical experiments. During respiration the intercostal spaces become narrower; the soft parts that occupy them are relaxed and projected into ridges in the direction of the pleural cavity. Under these circumstances the lymphatic spaces are obliterated and absorption is nil. During inspiration the expansion of the chest causes a widening of the intercostal spaces; the walls of the lymphatics separate, the stomata gape open, and absorption is invited.

When the pleural cavity is injected with fluids holding particulate

elements in suspension, the particles are only absorbed by the costal pleura; these particles (coloring matter) have never been found in the pulmonary or mediastinal pleura. The rapidity of absorption is in direct ratio with the frequency of the respiratory movements; as, for instance, after section of the pneumogastric, which causes the greatest inspiratory efforts on the part of the animals experimented upon. It is probable that the absorption of liquids is effected throughout the whole pleural surface, but the more solid contents are most probably absorbed by the costal pleura in the intercostal space, where the stomata, or gaping lymphatic mouths, are most numerous. The absorbent powers of the normal pleura are very energetic: if a saccharine solution is injected into the pleura, it will rapidly disappear, and the sugar can be almost immediately detected in the urine.[1] Like all serous membranes, the pleura consists of a single endothelial cellular layer (of the irregularly-shaped polygonal type) resting upon a basement membrane.

With Germain Sée, we will repeat that whatever may be the pathogenesis of a given pleurisy, the pathology of the process always reduces itself to three histological conditions: viz. congestion, exudation, and proliferation. The difference in the degree of intensity in either the whole or each one of these conditions constitutes the basis for the differentiation of the clinical types of this disease. By taking the commonest and most classical type of acute pleurisy, the sero-fibrinous variety, as an illustration, we will find it easier to study the evolution of the pleuritic process and demonstrate more effectively the essential difference between this and other types.

The initial fluxion and congestion is the primordial fact in pleuritic inflammation. It may be characterized by simple discoloration or the most intense ecchymotic injection of the pleura. The blood-vessels are dilated and gorged with blood, the lymphatics and lymph-spaces distended with leucocytes, and the connective-tissue inter-spaces are swollen with a flood of plasma. The epithelial surface cells swell, rapidly proliferate, become stratified with superimposed layers of embryonal cells, which are continuously shed and dropped into the more dependent portions of the pleural sac when they mix with the serum that is constantly transuding from the swollen pleura. The fibrinogen of the effused serum is now acted upon by the fibrino-plastic matter of the leucocytes of the pleura and of the embryonal tissue, so that fibrin is rapidly formed. The coagulation of the fibrin thus formed upon the inflamed surface gives rise to the rough "bread-and-butter" appearance which is so readily recognizable by the naked eye in the earliest days, even hours, of the inflammation. The fibrin thus exuded constitutes the *pseudo*-membrane of pleurisy; but the

[1] M. Sée, *Dict. Dechambre*, 1888.

morbid activity of the inflamed pleura does not end here, for in the course of a few days a true new granulation-membrane is developed directly from the pleura as a histological part of the serosa, and not a mere exudation which is foreign to it, as in the case of the fibrinous pseudo-membrane of the acute stage. The difference between these two formations is a capital one from both the pathological as well as therapeutic standpoint, and should be well appreciated; for the first is a temporary formation, the removal of which may be hastened by remedial measures, while the other is a permanent condition that practically defies all treatment.[1]

As fast as these granulations develop, the primitive pseudo-membranous and avascular fibrinous layer which overlies them undergoes a rapid fatty degeneration, the fibrils of the degenerate exudate being absorbed by the lymphatics. Finally, the embryonal cells of the granulation-tissue assume a more adult type, so that when the serum interposed between the opposed visceral and parietal surfaces is absorbed, and the opposing granulations are allowed to come in contact, adhesions take place which permanently bind the opposed surfaces by firm bands of fully-formed connective tissue. On the other hand, when the absorption of the effused fluid is too long delayed and apposition is prevented, then the granulation-tissue cells mature, and end by forming a true endothelial surface of adult pavement cells, simulating the original pleural surface, and giving to the new membrane that peculiar lustre or polish that characterizes the cystic interior of the very chronic cases. It is easily understood that in such cases the prospect of securing obliteration of the pleural cavity by adhesion, even after the permanent removal of the contained fluid, is hopeless, since the apposed smooth surfaces will no more unite than will the original surfaces of the healthy pleura. The *rationale* of the excision or extirpation of this thickened pleura after resection of the costal walls, as successfully practised by Schede of Hamburg, Kuester of Berlin, and others, is well understood, and its justification, as the only radical means of relief, appreciated.

We have already described the method by which the fibrin exudation of acute pleurisy is formed, and we have incidentally explained that in consequence of the great afflux of blood to the pleura a large amount of liquid plasma is exuded. The laws that determine the

[1] The older authors believed that this new vascular membrane was produced by the *organization* of the exuded fibrin, whereas it is now well understood, since the investigations of Virchow, Robin, Charcot, Vulpian, and others, that the formation of the new granulation-membrane is coincident with the disorganization and disintegration of the primitive pseudo-membranous exudate. The new membrane is formed by the proliferation of the endothelial cells associated with a rapid process of vascularization originating in the pleural capillaries proper, and causing the formation of a typical granulation-tissue.

amount of this fluid exudate have not been fully discovered. It is certain that the intensity of the initial congestion does not determine the quantity, because it is notorious that some of the most painless and insidious pleurisies—*e. g.* latent pleurisies—are the ones that are frequently associated with the largest amount of fluid; while, on the other hand, usually the most acute (primitive) pleurisies are frequently arrested at the incipiency of the plastic stage, and are followed by early adhesion of the apposed pleural surfaces. At any rate, the existence of this serous exudate is one of the capital facts in the history of pleurisy; and it is its presence which occasions the most dangerous complications and calls for the most energetic treatment.[1]

We have already noticed the evolution and involution of the more solid products of pleural exudation. We must now simply mention that when recovery takes place the effused fluid is either rapidly or gradually absorbed, the floating flocculi of fibrinous exudation disappear by absorption and approximation of the apposed pleural surfaces takes place. The fibrinous pseudo-membrane, if it exists, may cause a temporary agglutination of the pleural surfaces, but this is not permanent until the vascular granulations of the true new tissue which underlies it have coalesced, and a network of adhesions is formed by a newly-developed connective tissue of the adult type.

We have also stated that the character of the exudate distinguishes the nature of the pleurisy. We can now add that the sero-fibrinous pleurisy is distinguished by a predominance in the amount of liquid exudate; the acute plastic pleurisy by the preponderance of fibrinous *pseudo*-membranous exudate and scantiness of fluid; the true dry

[1] This liquid is nothing else than diluted blood-plasma. The proportions of its constituent elements vary with the acuteness of the inflammation that causes it. The albumin and fibrin which it contains are in greatest excess when the inflammation is most intense. In old or chronic effusions, in which the inflammatory process is of a low or sub-acute grade, the fluid is very poor in coagulable matter. The same may be said of the morphological elements which are found in it. The more recent and acute the process, the more abundant will they be. It has been claimed, and with some good evidence, that the wealth of the fluid in solid constituents furnishes indications of prognostic value. Laboulbène believes that the cure of a pleurisy is more likely to be rapid if the quantity of fibrin is great. Mehu and Constantin Paul have proved almost conclusively that the poorer the effusion is in solid matter the more promptly will it reproduce itself (Vidal). Repeated observation has convinced the author of the correctness of this assertion, and while he admits with Fräntzel and others that this is not always true, he still believes the truth of the general conclusions.

In connection with the microscopic characteristics, it should be remembered that even the most limpid serum removed from the pleural cavity reveals the abundant presence of blood-corpuscles. Dieulafoy teaches that any specimen that contains no more than 3000 red corpuscles to the cubic millimetre has no tendency to suppuration, while if it contains more than this it is almost certain to become purulent. When discussing the treatment of empyema we will dwell upon the later revelations of mycological investigations, and will refer to the more positive and reliable indications furnished by bacteriological tests.

pleurisy,—*pleurésie proliférative* (Lancereaux), *chronic hyperplastic pleurisy* (Vidal), interstitial pleurisy (Loomis),—is distinguished by almost the total limitation of the process to the formation of a new granulation tissue, ending invariably in true connective-tissue adhesions. In the more aggravated and typical cases the connective-tissue proliferation is of a progressive character, involving the whole pleura and causing a total obliteration of the cavity, encapsulating the lung in a sclerogenic mass which may lead to chronic fibroid changes in the lung itself, and thus produce the permanent atrophic alterations which characterize pulmonary cirrhosis of pleuritic origin,—the chronic pleurogenous pneumonia (*pneumonie chronique pleurogène*) of Bronardel and Charcot. Under these circumstances it will be readily understood that in this rarer form of pleuritic disease the new connective-tissue formations which are started in the pleura constitute simply the beginning or initial stage of a morbid process—a process which ends in the lung itself, and is not the *finale* of a pleurisy.

From this synoptical review of the more essential inflammatory pleuritic changes it is plain that the spontaneous cure of this inflammation may be accomplished by the unaided efforts of Nature—a fact that has been sufficiently proven since the days of Skoda and the Viennese school of therapeutic nihilists. The natural cure of the disease, which is mainly effected by the spontaneous absorption of the exuded products and the final adhesion of the apposed serous surfaces, is in reality an intrinsic characteristic of all the *acute* non-purulent pleurisies.[1]

It is only in the chronic cases, in which the absorbent functions are interfered with by an insuperable barrier of connective-tissue neoformation, or in which the presence of a complicating agency (tubercle) which perpetually maintains the effusion, that the natural process fails, and a cure can only be effected by therapeutic intervention. In the purulent pleurisies the resources of Nature are powerless to correct the morbid process, the natural means of securing the removal of the purulent product leaving always imperfect results, which are inferior to the opportune intervention of the therapeutist.

The natural tendency to recovery must necessarily depend upon the underlying pathogenic and anatomical conditions. In general terms, this *tendency* may be stated to be *greatest* in *a*, the most acute type, the acute plastic pleurisy (characterized by large fibrinous exudation and scant serous effusion); *b*, *less* in the subacute or sero-fibrinous pleurisy (with predominance of serous effusion); *c*, *still less* in chronic serous pleurisy with hyperplastic walls; *d*, *none* in the purely hyperplastic or interstitial progressive variety; *e*, *worse* in the purulent varieties.

[1] Out of 200 cases of pleurisy reported by A. L. Mason 132 recovered without having to resort to thoracentesis, *Bost. City Hosp. Reports*, 3d Series, 1882.

In prognosis this intrinsic tendency to recovery may be, therefore, graphically expressed as follows: acute pleurisy, very good; subacute pleurisy, good; chronic pleurisy, fair; hyperplastic pleurisy, bad; purulent pleurisy, very bad.

The frequent occurrence of spontaneous recovery led at one time to a methodical expectancy, a quasi-complete therapeutic nihilism, which, while very instructive in the way of studying "the natural course of disease undisturbed by therapeutics" (Skoda), was conducive to the most disastrous practical results. In healthy contrast with this perilous tendency we quote the language of Fräntzel,[1] who, writing in 1875, impressively says: "There are many physicians, even now-a-days, who adhere to the expectant method which came in vogue now more than thirty years ago, and who recommend that pleuritis should not be submitted to medical treatment unless special symptoms are present which threaten life. They assert that inflammation of serous membranes—pleuritis, pericarditis—unless attended by very great effusion, are not dangerous diseases and will get well of themselves. What infinite mischief has the adoption of this view already inflicted on such patients! It is only necessary to have once seen with observant eyes how such patients inevitably and with the direst sufferings are condemned to certain death to induce us to strive with all our might in every fresh case of pleuritis or pericarditis to quickly reduce the inflammation and bring about as complete an absorption as possible of the deposited exudation."

When we consider the disastrous consequences of exudation in binding down and permanently crippling the expansive power of the lungs, and thus permanently subtracting a large respiratory area from the patient; when we consider the risks incurred by those who carry with them the large unabsorbable accumulations of chronic pleurisy; when we look on the permanent skeletal deformities induced by those who recover from these effusions,—it is realized that neither the expectant nor the purely symptomatic treatment can be the ideal of the practitioner, whose aim should always be directed toward a *restitutio in integrum*, and not a cure *ad partem*, as we are still unfortunately so frequently compelled to admit is the result of our best and most approved therapeutic efforts.

The question which, therefore, presents itself for consideration at the very threshold of this subject is, Can acute pleurisy be aborted? Is it possible to jugulate the inflammatory process at the very start, so as to modify and weaken it sufficiently to abbreviate its duration and prevent the formation of the formidable and mischievous exudations that result from it?

This is an old question, and one that has been exhaustively dis-

[1] *Ziemssen's Cyclopædia.*

cussed by all systematic writers, both ancient and modern, and in the most contradictory manner. The older authors—we mean those who flourished after Pinel and Laennec, who first differentiated pleurisy from pneumonia and established its independent position in nosology—gave very serious thought to the subject, and according to their observations, particularly those of Andral, Bouillaud, Louis, and Chomel in France; Cullen, Pearson, B. Bell, Cooper, Abernethy, Alison, Marshall Hall, Watson, and Walshe in England—whose powers of observation are unimpeachable—such an achievement was possible. The antiphlogistic treatment, free and repeated venesection *ad deliquium animi*, and wet cupping were the means by which this result was obtained. There was no question then as to the benefit of bleeding, only the quantity of blood to be abstracted was the subject of controversy. Over fifty years have now elapsed since that time, and, while there are yet at present men who stoutly uphold the correctness of the old practice—M. Peter in France, for instance (1880), and Meyer and Fräntzel in Germany (1882)—things have so changed that it has now become an anachronistic absurdity to discuss the efficacy of venesection unless it be to denounce it.

Without attempting to enter into the merits of the question, we cannot help wondering at the extreme oscillations of the pendulum of professional opinion, and asking ourselves why the modern generation has set itself down so firmly against the use of the lancet when our ancestors gloried so enthusiastically over its merits. It is remarkable to read that so competent and careful an observer as Louis, who cupped and bled his pleuritic patients, maintained in the discussions of the French Academy that "Pleurisy rarely, if ever, caused death." Professor Peter, who has lived to practice most actively both the older and modern methods of treatment, says that "if the old method of treatment was followed more often now-a-days, there would be less frequent appeals to the aspirator and to the knife, and that pleurisy would claim a much smaller mortality."[1]

Those who are especially interested in the question raised by Professor Peter would do well to consult the refutation given by Dujardin-Beaumetz in his admirable *Leçons de clinique thérapeutique*.

In direct contradiction to the recent claim of Peter we may listen to the opinion of the elder Flint, whose calm and unbiassed judgment, based upon an enormous professional experience in this country of over fifty years, deserves the great consideration that has always been accorded to the utterances of this foremost of American clinicians. In speaking of the influence of bloodletting in the treatment of pleurisy, he says: "Experience and pathological reasoning combine to show that bloodletting does not exert a *direct* controlling effect upon an

[1] *Leçons de Clinique médicale*, 3d ed., 1880.

inflammatory disease. It may exert a powerful immediate effect as a palliative measure, but whatever curative power it may possess is exerted *indirectly*. Its therapeutic action, in general, consists in lessening the force and frequency of the heart's action, in other words, in diminishing the intensity of the symptomatic fever. In the early period of an acute inflammation accompanied by high febrile movements, as indicated by a pulse accelerated and of abnormal strength, the abstraction of blood affords relief and may contribute to a favorable progress of the disease. It should enter into the treatment of a certain proportion of cases, *provided other and more conservative means for the same ends are not available*."

"The evils of bloodletting arise from the spoliative effect upon the blood. It diminishes the red globules, and these during the progress of the disease are not readily reproduced. It induces thus the anæmic condition, and in this way impairs the vital powers, etc. . . . . The useful effects of bloodletting may frequently, if not generally, be obtained by other means, which require less circumspection in their employment, because if injudiciously resorted to they are in a less degree hurtful, etc."[1]

It is unnecessary to state that the views of this distinguished observer, whose authority has stamped with its influence the practice of many generations of American physicians, are those of almost all representative clinicians the world over.

For our part, we can conscientiously state that throughout a large hospital and private experience during the last twelve years we have never seen a case of acute pleurisy in which we felt that the abstraction of blood by venesection was necessary or justifiable. This was not due to prejudice, but simply because of the inherent weakness of the patients, which radically unfitted them for venesection—a peculiarity common to all large metropolitan populations, which Peter himself admits interferes with bloodletting in Paris itself. It should be added that throughout our private experience we have acted independently and without bias against bloodletting; in fact, we have never failed to resort to the lancet in any condition in which vascular depletion appeared to be the best means of affording relief—*e. g.* failure of the circulation from over-distension of the right heart, etc. This is partly due, however, to the fact that the majority of hospital cases have applied for relief after the acute stage had passed, and the existence of the second exudative stage precluded the consideration of all depletive measures. Neither can we state that in private practice has venesection ever appeared necessary, since in all the cases the prompt application of other remedial measures has given the most satisfactory relief from all the symptomatic phenomena.

[1] *Principles and Practice of Medicine*, 4th ed., 1873.

In summing up the status of modern opinion in regard to bloodletting in pleurisy we may state that, while the immediate benefits of bloodletting are not denied, they are nevertheless not accorded the enormous importance of former years, the effects of venesection being only indirectly beneficial and not specifically curative. Since bloodletting affords only symptomatic relief, and does not prevent the further evolution of the pleuritic process into its more mature and dangerous stages,[1] it cannot be regarded as a jugulating agent in the highest sense, and must consequently be supplanted by other therapeutic agents that afford the same symptomatic relief with decidedly less damaging effect upon the patient's resources. We may add, also, that the great therapeutic discoveries that have been made in the last few years have, much more than the influence of doctrinal objections, greatly justified the modern aversion to bloodletting. It is very natural that with the scarcity of positive potent therapeutic agents which characterized the practice of the middle and earlier periods of this century, the immediate brilliant effects of venesection should have assumed magnified proportions, but it is equally plain to understand why with a better appreciation of the etiology and natural history of disease, and a better understanding of the effects of drugs (especially the positively brilliant additions that have been made to the materia medica in the last ten years), that the effects of bloodletting should have been completely overshadowed and forgotten.

Finally, while we cannot claim for modern therapeutics the absolute power of jugulating the pleuritic process in all cases, we can emphatically state that we are able greatly to diminish the severity or violence of the initial stages, and probably control its career in a way more prompt, more conservative, and more efficient than by the depleting practices of the antiphlogistic system.

TREATMENT OF THE FIRST STAGE: HYPERÆMIA AND PLASTIC EXUDATION.

Apart from the possibility of aborting or jugulating the inflammatory process at the very onset of the invasion, there are several indications (*indicationes morbi*) which demand the attentive consideration of the therapeutist.

The first of these is the physiological indication of rest. In pleurisy general (or bodily) and local rest are demanded by the inflamed serosa.

Rest.—Long ago, Mr. Hilton, in his admirable lecture on *Rest and Pain*, pointed out the resemblance between the pleura and pericardium and joints. Much longer before him Bichat had already established

[1] Some authors as competent and careful as Loomis contend and teach that bloodletting really favors the greater transudation of serum in the second stage.

the anatomical and physiological unity of all the serous membranes. The pleural cavity represents a huge joint constantly in motion. It has two surfaces covered by serous membrane, gliding smoothly upon each other by the aid of lubricating fluid. Mr. Hilton applied his law of associated muscular action, nerve-supply, and function to the pleura, showing how, when inflammation takes place, the nerves of the pleura that are directly in communication with those supplying the intercostal muscles call for cessation of movement, and that the pain felt in the skin over the inflamed area is the agent by which the needed rest is obtained. "Practically, the same thing occurs in the joint that is inflamed and painful from acute rheumatism. Probably the resemblance between this inflammation of a serous membrane and that of a joint could be more striking were the conditions exactly similar. But in the case of the pleural serous membrane complete rest cannot be obtained. The lungs cannot cease breathing and the heart cannot stop beating." Probably, as suggested by Hilton and Powell, this accounts for the more fibrinous and adhesive character of the effusion, a further effort of Nature to secure rest. In the case of the joint immediate rest is secured, and the effusion is not adhesive in ordinary cases.

It is doubtless due to the influence of Hilton's teachings that the attempt at securing rest by fixing the affected side, and thereby diminishing the respiratory movements, is so frequently applied at the bedside. This practice, which is so largely followed in English and American hospitals, is a good one in the acute stage. There is no doubt that much comfort is given to the patients by it. The method (Robert's) simply consists in applying strips of adhesive plaster two to three inches in breadth, extending from the spine posteriorly to the sternum anteriorly, around the affected side. This was the method almost invariably practised by the late Professor Samuel M. Bemiss of New Orleans, who always expressed himself as highly pleased with it throughout his large and eminently successful practice.

Following the same idea, Richard Otto of Dorpat[1] recommends that an ordinary cotton bandage, two and a half to four inches in width, be applied tightly to the thorax. This compression he believes is useful whether the inflammation has just begun or whether it has passed to the second stage. In either case, if the bandage is tightly applied, it will give great relief. At first it is rather uncomfortable, but if removed at the solicitation of the patient he will soon beg to have it reapplied.

In addition to these local mechanical restraints, it is necessary, no matter how mild the case, to place the patient in bed. The patient should be allowed to place himself in the position in bed which he

[1] *Berlin klin. Woch.*, Sept. 30, 1889; *Annual of the Universal Medical Sciences*, 1890.

finds most comfortable. He should be forbidden to talk, and should be prevented from making any unnecessary movements, and a nutritious but plain diet, without stimulants, should be given him.

In the way of hygienic indications the sick-room should be well ventilated and kept at a temperature of about 65° F. (Loomis).

As a preliminary to further treatment a saline purgative is usually prescribed. A pint of the effervescent solution of the iced citrate of magnesium, taken in broken doses, a double dose of Seidlitz powders, a dose of compound cathartic pills, a draught of the purgative mineral waters (Hunyadi Janos, Friedrichshall), an ounce of Epsom salts, or 1 drachm (3j) of the pulvis hydrargyri chlor. mite et jalapæ (*National Formulary*), constitute a repertory from which a selection may be made that will suit the requirements of any particular case. As a general rule more powerful purgatives should be reserved for the more robust and plethoric patients. The evacuations resulting from these purgatives should be passed in a bed-pan, so as to cause the least disturbance of the patient.

In addition to the preceding indications, the call to diminish the intensity of the pleural engorgement is one of primary importance at this stage of the disease. To meet this indication was the object of the older antiphlogistic method with its large bleedings and violent emeto-catharties and counter-irritants. While modern practice has totally discarded venesection, it has not been able to dispense altogether with the principle of local depletion, counter-irritation, and derivative medication, and still tolerates it, though in such an attenuated form that the practice would be repudiated as such by the disciples of Rasori and the exaggerated school of contra-stimulation. At present local depletion, the blister and the lesser counter-irritants, the purgatives, diuretics, and diaphoretics, are the only relics that have survived the general downfall of antiphlogism.

While we have never had occasion to realize the necessity for venesection, especially that large and repeated bloodletting *ad deliquium animi* which was formerly regarded as essential for the control of the disease, we do believe that the local abstraction of blood—say 4 to 6 ounces—by means of the wet cup is an excellent means of obtaining an amelioration of the local symptoms and general distress, the relief being out of proportion to the amount of blood abstracted. By means of the cupping-glasses with air-tight stopcocks, that may be attached to the ordinary Dieulafoy or Potain aspirator or the Allen surgical pump, a vacuum can be promptly obtained, so that, after preliminary scarification with the special instrument for the purpose, the desired local depletion can be very effectively obtained without much annoyance to the patient.

This wet cupping, if resorted to at all, should be applied at the very

earliest moment of the initial stage: it is almost exclusively indicated in the acute pleurisies with very inflammatory, painful, and feverish symptoms of robust and plethoric subjects. In all other pleurisies, with subacute symptoms occurring in debilitated subjects, it is positively contraindicated. For this reason cupping will always remain a more popular and effective indication in healthier rural districts than in metropolitan practice.

It is in the class of the subacute pleurisies in weaker patients that another relic of the antiphlogistic system—the blister—will always continue to find application.

While the blister has never had more powerful enemies than in the present decade, its triumphant survival in the treatment of inflammatory affections of serous membranes, and in this one specially, is one of the best proofs of its utility. As a rule, the majority of systematic writers deprecate the application of blisters in the acute or initial stage of pleurisy, even when they advise it in the later stages. Nevertheless, it is apparent to anyone who considers the pathological anatomy of pleurisy that blisters or any other counter-irritant is much more likely to accomplish its purpose in the early stages of the disease, when the membrane has not been seriously altered, than in the later stages, when a thick coat of exudation has been spread over its internal surface. It is in the later stages, when absorbent orifices of the lymphatics are entirely plugged by exudation, that we fail to see the rationale of the counter-irritant. We believe with Professor Peter that if blisters are at all useful in pleurisy it is in the first stage, and rarely in the later stages.

In Louisiana, where the older traditions of the French school still linger among the Creole population, the blister, if not constantly applied, is almost always expected in all pleuro-pulmonic phlegmasiæ, and, while there is frequent abuse of this agent, the beneficial results that are constantly observed from its application leave no doubt in the mind of the unprejudiced observer of its possible utility. The blister, if applied, should never remain longer in contact with the skin than the time necessary to produce vesication. The epidermis should not be removed, but should be simply punctured to allow the retained serum to escape. To make a blister suppurate by the application of irritating ointments, etc., is absolutely unnecessary under any circumstances. It should be remembered that the blister is to be used most cautiously in children on account of the strangury and other evidences of cantharidism that it is more likely to produce. It is of course absolutely contraindicated in all albuminuric subjects or those affected with genito-urinary diseases, for a like reason.

In ordering the blister the emplastrum cantharidis (*U. S. Pharm.*), freshly prepared, should be preferred to the numerous ready-made

vesicating plasters that are found in the shops. The size should be regulated by the area and intensity of the pain. Cantharidal collodion (collodium cum cantharide, *U. S. Pharm.*) may be also applied with a camel's-hair pencil in lieu of the blister, but the unreliability of this article is notorious, and the plaster is to be preferred whenever a prompt and energetic action is desired.[1]

In the milder cases, in which the pain is not very intense nor the fever high, dry cupping, by means of the aspirating pump already mentioned, and followed by turpentine stupes prepared with flannel cloths large enough to cover the affected side, wrung out of hot water and sprinkled with spirits of turpentine, is excellent local treatment. Mustard, whether in sinapism or in the shape of the leaves sold by the manufacturer, is a most elegant but less effective and more painful counter-irritant. When alternated with applications of tincture of iodine it is useful in the treatment of the "dry" pleuritic stitches of phthisis.

In children counter-irritants cannot be applied as in adults. They cause great pain, restlessness, and even delirium, and for this reason gentler means of drawing the blood to the surface must be resorted

[1] In ordering a blister the precaution should not be omitted to make frequent examinations of the underlying skin in order to withdraw the plaster when vesication has taken place. This effect is usually observed in three hours, though in many cases, especially when applied to older and less sensitive skins, it may not be observed for several hours longer. When the vesication is produced, the plaster must be removed and a warm, very mushy, and hot flaxseed or slippery-elm poultice must be applied. The poultice has a very soothing effect upon the blistered surface, especially if the proximal surface of the poultice is smeared with hot green oil (ol. hyoscyam. infus.), or preferably the *Baume tranquille* of the French Codex, which is so largely used by the Creoles in Louisiana. The poultice may be renewed every three hours during the first day, when the large serous accumulation under the blistered surface is to be drained away by puncture of the blister without removing the pellicle. After this the poultices are discontinued, and replaced by a dressing of antiseptic oil, preferably applied by keeping cloths saturated with a mixture consisting of

R. Campho-phenique, ʒij;
Liq. vaselini, q. s. ad ʒvj.—M.

This application has the advantage that it will require less frequent renewal than the ordinary salves and oils that are generally used in the household. In this connection a very convenient and useful dressing not generally known in this country, which was introduced a few years ago by M. Lelievre, a French chemist, and known as the instantaneous Iceland-moss poultice (imported by E. Fougera & Co. of New York), is worthy of notice. In treating travellers, single persons, etc. this application offers especial advantage. It consists of a substance extracted from the *Fucus crispus*, which is preserved in sheets like paper. For use a piece of suitable size is cut and dipped in warm water; it swells rapidly, softens, and can be immediately employed as a poultice. It can be soaked in the liquid antiseptic vaseline already mentioned, and can be allowed to remain indefinitely upon the blistered surface, as it does not decompose. If hot water alone is used, the heat will be retained by the gutta-percha tissue or thin oiled silk sheet which always accompanies these poultices as prepared by the manufacturer. In very sensitive persons oleate of cocaine (4 per cent.) and morphine may be added to the vaseline with which the poultice is saturated.

to. Nothing is better in this class of cases than a flax-seed poultice, which, acting as a cutaneous derivator, also soothes the engorged pleura by the direct effect of heat. Even in adults, hot flax-seed or slippery-elm poultices, if not too heavy, applied as a partial jacket to the whole side, give great relief.

The chest-dressings of Von Gieth and Hunt, which have been recently introduced, are worthy of mention as substitutes for poultices in the very painful cases, in which the movements of the patient are interfered with, and in which a permanent dressing, to last for several days, is desirable.

The dressing of Professor Von Gieth of Munich, which has been recently described by Dr. Thornton Parker,[1] is particularly adapted to infantile cases. It is prepared as follows: "Pure olive oil (no other substance will be just as good) is poured in sufficient quantity into a previously warmed bowl, and a strip of old soft cotton cloth, large enough to encircle the chest, is placed in the bowl and completely saturated with the oil. This is then applied to the patient's chest, and outside of it a second strip of dry cloth is placed, and, if necessary, a third, which completes the dressing. This application is said to be most acceptable to patients, and more successful in results than the other applications previously recommended." Over this, Otto's chest bandage, previously described, to diminish the respiratory movements and secure rest, may also be applied.

On the other hand, the dressing recommended by Dr. William Hunt of Philadelphia[2] commends itself for its cleanliness. "If there is to be any cupping or any other preliminary operation, that should be attended to first; then all the ingredients wanted are pure collodion (flexile) and absorbent cotton in smooth layers and a good brush.

"Apply a very thin layer of cotton over the affected side from spinal column to sternum, and secure with collodion smeared thoroughly over it. Then go on with thicker layers, securing them with collodion until a good padding is obtained, paying particular attention to the edges. In double cases the dressing may encircle the chest."

Finally, to conclude with the external applications, which are intended to relieve the pleural inflammation in the first stage, we will simply mention cold applications to the chest. This is unquestionably a very unpopular treatment in the Southern United States, where, as in all warm and tropical countries, cold in pleuro-pulmonary inflammations has always been looked upon with distrust. It is probable that outside of Germany and other colder countries, where, through the influence of Niemeyer's teachings, it obtained a foothold in certain clinics, it is rarely, if ever, applied. The ice-bag, snow poultices, cold compresses, etc., may appeal to *a priori* reasoning, but experience is

[1] *Med. News*, May 9, 1891. [2] *Annals of Gynæcology and Pediatry*, Feb., 1891.

against them. Even Fräntzel,[1] who is an authorized exponent of German teaching, objects to it, because the cold often brings on violent fits of coughing, and thus an increase of the inflammatory action. Its chilling influence is certainly very disagreeable to most patients, who almost invariably find more comfort in hot applications.

Thus far, the therapeutic recommendations that have been presented for the treatment of the acute stage of pleurisy have been, with the exception of the better appreciation of the value of rest for the inflamed pleura, almost all simply modifications of the older methods of treatment, which were as well understood in the earlier part of the present century as at present.

The present generation, while eliminating the more objectionable features of the antiphlogistic system and accepting its more salutary teachings, has departed essentially from previous ideas in its appreciation of the therapeutics of one agent—opium—and has thereby wrought a most radical and beneficial change upon the treatment not only of pleural, but of all serous, inflammations. In 1873, Austin Flint, Sr.,[2] in dealing with pleurisy, wrote: "A great change has taken place within the last few years with respect to the use of opium in acute inflammations. It was formerly used with much reserve under the apprehension that, acting as a stimulant, its influence upon the local disease must be unfavorable. It was regarded as antagonistic to the antiphlogistic plan of treatment. Clinical experience and sounder pathological views, however, have led to the knowledge of its great value in the treatment of inflammatory affections wherever situated. It is valuable not only as a palliative, but as a curative remedy. . . . . The immediate effect of this remedy is often very strikingly manifest in improvement as regards the local and general symptoms."

The change in opinion with respect to this drug was at first brought about by experience, which was subsequently confirmed by the results of more advanced physiological experimentation. Brunton[3] teaches that opium by its action on the vaso-motor centre in the medulla, and especially by its action on the peripheral terminations of the vaso-motor nerves, which it *contracts*, will prevent or diminish the reflex dilatation of the vessels which the local irritation would otherwise produce. Congestion will thus be diminished and inflammation will be relieved. We thus find in opium an agent which not only acts in a *direct manner* upon the pleuritic process *in loco*, but also by its relief of the symptomatic phenomena—pain, cough, and dyspnœa—through its influence on the sensory apparatus, ensures a degree of local physiological rest to the inflamed organ which is of infinitely greater benefit than that which is obtained by mechanical restraints.

[1] Article in *Ziemssen's Cyclopædia*. [2] *Practice of Medicine*.
[3] *Pharmacology*, etc., 1885.

The late Sir Robert Christison used to say that not only coryza, but probably all inflammations, could be nipped in the bud by opium if it were given sufficiently early and sufficiently freely. This utterance has been strongly confirmed in the treatment of acute pleurisy, the almost unanimous consensus of opinion in this country being entirely in favor of this drug or its more elegant alkaloids.

Loomis[1] says: "The only remedial agent which has seemed to me to have a controlling power over acute pleurisy is opium;" and his opinion is shared by almost all systematic American writers.

The most rapid and effective method of administering opium is by the hypodermic injection of morphine. The injections ($\frac{1}{4}$ gr. each) or the syrup of morphine (1 grain to the ounce) must be administered in sufficient quantities to relieve pain. The effect is the best criterion of its proper administration. This remedy will usually be required during the first week of the disease, during which time the patient should be kept under its influence.

In cases in which the stomach is irritable the hypodermic method is particularly indicated. In the more marked febrile cases its combination with analgesic antithermics—antipyrine, antifebrin (acetanilide), or phenacetin—will be followed by the happiest results.

In the more acute cases a hypodermic injection of morphine should precede all other treatment, the remarkable improvement which follows the initial injection frequently moderating the tendency to counter-irritant and derivative measures which the practitioner would otherwise be tempted to push with unnecessary vigor.

In cases in which the presence of malaria is suspected as a complicating factor, the combination of quinine and morphine is indicated (quinine 20 grains, morphine $\frac{1}{2}$ grain in capsules or wafers); and the effect of this should be maintained by the repetition of smaller doses (quinine 5 grains, morphine $\frac{1}{8}$ grain) every four hours.

The combination which was so much employed formerly (calomel and opium) owes its virtues to the opium. Bartholow says: "If constipation is a feature of the cases, especially if nausea accompanies it, and if there be evidence of congestion in the portal circulation (which is so common in alcoholic and malarial subjects), the most important results may follow the exhibition of a sufficient dose of calomel. The dose should be, as my experience goes, from 3 to 5 grains, and the reasons for its use are that calomel has a distinctly sedative effect on the liver, lessens the physiological activity of its constructive apparatus, lowers the temperature of the blood passing through the hepatic veins into the general circulation, and it depletes by its purgative action the portal system."

This is probably all that remains at present of the old therapy of

[1] *Textbook of Practical Medicine*, 1890.

serous inflammations with mercurials (at least in the acute stage), when calomel was regarded in England and Germany as the sheet-anchor, the *sine qua non*, of the treatment. Mercurials at present only find direct application in the second stage of pleurisy, when their so-called *aplastic* effects may prove of value in preventing or promoting the absorption of the plastic fibrinous (unorganized) exudate.

Among the remedies which are also rapidly becoming obsolete in the treatment of acute pleurisy we would mention the group of vascular and cardiac sedatives, aconite and veratrum viride and tartar emetic. At one time digitalis was classed with this group, but a better appreciation of its physiological effect and a still better appreciation of its uselessness, if not harmfulness, in the acute stage, have withdrawn it from this group and reserved its great powers for other and better circumstances, when, as we shall see later on, it is capable of rendering great service.

While aconite and veratrum viride have been quite serviceable, especially in combating the febrile symptoms of the more pyretic types of pleurisy, and also by diminishing the intensity of the inflammatory process through the general circulatory depression which they cause, their popularity is rapidly on the wane, owing to the vigorous encroachments of the new analgesic antithermics, which are so reliable and positive in their effects and yet so free from the danger of these remedies.

It cannot be doubted that the therapeutics of the acute stage of primary pleurisy has been very greatly strengthened by the introduction of these remarkable derivatives of the aniline-carbon group. Chinolin, kairin, thallin, hydrochinon, pyridin, antipyrine, antifebrin, phenacetin, and salol have all been tried as rapidly as they have been introduced, and, while favorable reports were recorded of the beneficial action of the first five, opinion appears to have definitely settled on the superior value of the last four.

There is not the least question as to the prompt symptomatic relief that may be given to pleuritic patients by the administration of either antipyrine, antifebrin, phenacetin, or salol. By their use the fever is promptly lowered, the pain abates, and the general condition of the patient is very much improved. The profuse diaphoresis that follows the administration of these agents in febrile cases is also of marked derivative benefit, and entirely supersedes the older diaphoretics that were prescribed at this stage of this disease. One of the most valuable features presented by the therapeutic action of this group lies in the fact that their effect is marked in proportion to the intensity of the acute process. The more febrile and acute the invasion, the more rapid the effect. These antipyretics alone (especially antipyrine) are in many, if not the majority, of the cases quite competent to meet the

indications of the first stage entirely. While they cannot supersede opium altogether, their analgesic effect, especially that of antipyrine and phenacetin, will permit us greatly to economize the administration of opium or morphine. In this manner the constipating effects of the opiates are much minimized, while their full benefits are obtained. It is regrettable that exalgin, one of the latest members of this group, should be so toxic and variable in its effects; were it not for this it is possible that the therapeutics of the first stage of pleurisy might be written in the words: *antithermic analgesics*. At any rate, the beneficial effects of this group of remedies on the pleuritic process is so marked that many recent authors have claimed for them a real specific action. If this were the case, however, not only would the symptoms of the disease be subdued, but the local inflammation would also be arrested, and the disease would not proceed to the second stage. This is claimed to be true by several observers, but is not fully confirmed by the writer's experience. The frequency with which acute pleurisy is associated with the rheumatic diathesis has led many observers to the generalization that all idiopathic primary pleurisies—from the so-called *pleuritis a frigore* to latent pleurisy—are but local manifestations of this dyscrasia. This generalization, which is just as erroneous as Landouzy's teaching that all idiopathic primary pleurisies are tubercular, is nevertheless intimately connected with the empiric practice of administering known anti-rheumatics in acute pleurisy. In 1883, Aufrecht drew attention to the decided results he had obtained with the salicylates. In 1885, Müller and Glax,[1] Tetz,[2] and J. Drzewicki of Warsaw[3] confirmed his observations, the last-mentioned writer having tried salol in large doses with still more brilliant results. The marked anti-rheumatic properties of antipyrine, antifebrin, and phenacetin and salol would credit their beneficial action to this theory, the latest and extensive observations of M. Clement of Lyons[4] apparently demonstrating an almost specific virtue in antipyrine. Notwithstanding this, the author believes, as a result of personal experience, that the relief afforded by the antipyretics is mainly symptomatic, though in the true rheumatic cases the relief is as *specifically curative* as it is in acute articular rheumatism. In the other non-rheumatic cases the disease will progress onward to its later stages, though in a modified and less violent form. At all events, it is certain that either one or all—antipyrine, antifebrin, and phenacetin—are far superior to the salicylates, to which they should be invariably preferred.

These agents may be administered in various ways. As the taste

[1] *Greifswald Inaugural Dissert.*, quoted by Vidal, *loc. cit.*

[2] *Therap. Monats.*, No. 7, 1890.

[3] *Med. Rec.*, Aug. 25, 1888; *Annual of the Universal Medical Sciences*, 1889.

[4] *Lyon Médical*, May, 1891.

is not objectionable, their administration in a liquid menstruum is to be preferred: thus:

℞. Antipyrin. et phenacetin., *āā*. gr. xx;
Spiritus vini gallici, ℥ss;
Syrupi acaciæ, ℥j.—M.
Sig. One tea-spoonful every hour until fever and pain are relieved; then every two, three, or four hours.

The remedy should be suspended if profuse diaphoresis occurs (usually after the third or fourth dose), and is to be repeated when the fever returns. If there is much pain, the addition of morphine may be made as follows:

℞. Antipyrin. et phenacetin., *āā*. ʒj;
Syr. morphinæ sulph., (gr. j–℥j) ℥j.—M.
Sig. One tea-spoonful, after shaking thoroughly, every hour, as with preceding formula.

In case of malarial complication either antipyrine, antifebrin, or phenacetin may be administered in conjunction with sulphate of quinine and morphine in wafers or capsules, thus:

℞. Antipyrin. et phenacetin.,
Quininæ sulph., gr. v;
Morphinæ sulph., gr. ¼.—M.
Dispense in two wafers.
Sig. Take the wafers at half-hour intervals, and repeat the same quantity every two or three hours until pain and fever are controlled.

As a rule, however, it is preferable to administer the antipyretics and morphine in liquid solution or emulsion, and the quinine separately in capsules.

A good combination is that of phenacetin and salol in equal parts (generally in capsular form, 2½ grains of each) after the subsidence of the acute symptoms. Four grains of each of these two agents may be given every two hours to an adult as long as the first stage lasts, when the indications of the stage of effusion will call for a change in the treatment.

In summarizing the treatment of the first stage of acute pleurisy we should state that no special mention has been made of the treatment of the four cardinal symptoms of this stage—viz. *pain*, *cough*, *dyspnœa*, *fever*. But a separate and detailed consideration of the

symptomatic treatments is unnecessary, since the means that meet the *indicationes morbi* will equally relieve the *indicationes symptomaticæ;* thus, the *pain* will be relieved by local depletion, blisters or other counter-irritants, rest, opium, and the analgesic antipyretics; *cough* will be relieved especially by opium; *dyspnœa* will be relieved by the same agents that control pain; *fever* will be specially controlled by the analgesic antipyretics.

TREATMENT OF THE STAGE OF EFFUSION.

As has been already stated, in a certain number of cases the disease stops short at the dry or plastic stage, and the patient is said to have had a "dry pleurisy;" this, however, though common enough in secondary, and especially in tubercular, pleurisies, is rarely observed in cases which have presented in any degree the features of the acute illness characteristic of an attack of primary pleurisy.

In the typical cases the disease, therefore, progresses rapidly to the stage of effusion, this stage being recognized by the signs of liquid accumulation in the pleural cavity. Within a short time—it may be but a few hours from the initial signs of invasion—fluid commences to be effused, and dulness may be detected at the extreme base posteriorly, gradually extending upward toward the apex. With the occurrence of effusion the pain becomes less, the breathing easier and less catching, although quicker than natural. The movements of the affected side are notably lessened, whilst, in marked contrast to the effacement of respiratory sounds on the affected side, is their exaggerated intensity on the sound side. In moderate accumulations the dulness varies slightly with the position of the patient; whilst lying down, for instance, the resonance may be good to just below the nipple, whereas on sitting up there is dulness up to this point, and it may be higher. Over the lower portion of the dull area the respiratory murmur is absent, and the friction is no longer to be detected; but as the upper limits of dulness are approached in the scapular region, distant tubular breathing may be heard, and friction-sounds of a moister character are audible especially in front (Powell).

As the effusion advances the breathing becomes increasingly distressed, until apnœa is threatened.

The signs of pleuritic effusion are conveniently classed by Powell into three groups: (*a*) The cardinal signs of pleuritic effusion, the presence of which is alone essential for diagnosis—viz. (1) percussion dulness; (2) displacement of the heart; (3) annulled vocal fremitus; (4) diminished and altered or absent breath-sounds. These signs are common to both serous and purulent effusions.

(*b*) Subordinate or supplementary signs—viz. (1) increased semicircumference of chest; (2) intercostal bulging, elasticity, or fluctuation;

(3) Skodaic resonance; (4) altered voice sound; (5) displacement of abdominal viscera; (6) signs in other lung, especially puerile, healthy; (7) cardiac displacement *bruits*. These signs are none of them essential for diagnosis; any and all of them may be wanting.

(c) Signs indicative of nature of the fluid—viz. (1) aphonic pectoriloquy (Baccelli's sign); (2) temperature signs; (3) other pyrexial or septic phenomena. These are of special importance with regard to the diagnosis of empyæma, and will be discussed under Suppurative Pleurisy.

Presuming that the reader will find in the synoptical statement just made all that which is essential in guiding him to the differentiation of the therapeutic stages, we will proceed with the therapeutic indications.

"Whilst the inflammatory fever is at its height the less we meddle with any effusion present, unless it becomes of itself a danger, the better. We must bear in mind that a certain amount of effusion is as much to be looked for in acute pleurisy as exudation into the air-vesicles in pneumonia or 'running at the nose' in nasal catarrh, and the products in the three cases do not essentially differ. The pulmonary exudation consolidates *in sitû;* the nasal product stiffens the handkerchief; and the exudation into the closed pleural sac remains limpid and liquid only until the exposure to the air or some other means of microbic contamination determines a transformation of the serous to a purulent exudation. Again, given acute inflammation of the coverings of the lungs, a certain amount of effusion is useful in separating and bathing in a bland fluid the tender and inflamed surfaces, and, further, in keeping at rest the affected portions of lung. It is too often forgotten that the lung is in health exercising a constant traction upon the pleural sac, the vessels of which have, therefore, to sustain a negative or aspiratory pressure; this being so, it is but natural and physiological, if these vessels become temporarily weakened and congested by the inflammatory process, that increased exudation should proceed from them. The effect of this transudation is to neutralize lung-traction, and therefore to lessen the afflux of blood to the weakened vessels; it is, moreover, the surest and most natural means of giving that rest to the inflamed surfaces which they need for recovery. The effusion reaches its acme, the flow subsides, and in a few days the tide turns, absorption being effected in a few weeks. Fluid effusion being thus both natural and salutary in acute pleurisy, we must be watchful, but not meddlesome, in our treatment of its earlier stages: up to the end of a week or ten days we need not, in ordinary cases, seriously consider how to promote its removal, and in many, if not the majority of the cases, after this period the fluid will gradually subside by spontaneous absorption" (Powell).

It is generally agreed that the time usually taken for spontaneous absorption of serous exudation in acute pleurisy is from twenty to thirty days. If resolution has not taken place at the end of this time, and if the effusion remains stationary or shows a tendency to increase in spite of adequate treatment, then the case has ceased to be acute, and the disease may be properly assumed to have entered into its chronic phase, and hope for spontaneous absorption must be lessened if not abandoned.

What should be the treatment while there is hope of spontaneous absorption—*i. e.* during the first four weeks following the advent of the second stage?

As a preliminary to the answer to this question it should be stated that our ability to relieve Nature by pharmacological or hygienic means decreases *pari passu* with the length of time that elapses after the fourth week of the effusion. The reason for this is obvious. The longer the effusion remains, the more marked become the pathological alterations in the pleura; structural changes take place, characterized mainly by the consolidation of the plastic matter and the increased formation of true granulation-tissue; the exudation loses its elasticity, the lung becomes more firmly bound down, expansion is increasingly difficult, and with time impossible. Under these conditions the highly absorbent properties of the pleural serosa become rapidly impaired, and finally lost. When this plastic obstruction of the lymphatic stomata has taken place, and a thick barrier of ill-organized exudation is interposed between the vascular and lymphatic absorbents and the contained fluid, what can be expected from derivative, counter-irritant, alterative, or any other sort of deobstruant medication? It is plain, therefore, as Peter has well shown, that if the therapeutist is going to interfere with medicinal agents with the view of aiding the oppressed pleura, he must do it in the earlier or acute stage of the effusion, and not later on when the fluid is encysted in a practically impenetrable capsule of exudate.

Therefore, as soon as the pain of the acute stage has subsided and the friction-sound gives way to the signs of effusion, the administration of opium should be discontinued, and such modifications in the dietary as well as treatment should be prescribed as will better suit the changed pathological conditions. It should be remembered that the indications call for a treatment (1) that will promote serous absorption; (2) that will promote fibrinous, pseudo-membranous, disintegration and absorption; (3) for remedies that will arrest or diminish cellular proliferation (neo-membranous or granulation formation); (4) agents that will promote pulmonary expansion.

As already stated, the patient should not be subjected to any serious annoyance on account of the serous effusion; only in case the quantity

should rapidly increase to alarming proportions. The patient should be given an opportunity to rally after the greater distress and fever of the first week. The digestive and eliminating organs should not be too severely taxed by the purgatives, diuretics, or diaphoretics while they are already severely overworked in attempting the removal of the products of tissue metabolism resulting from the fever and pain.

During this period of rest immediately following the first week of the attack plain but more nutritious diet should be given, the patient should be allowed to sit up, and if the tenderness of the affected thoracic region has ceased, the systematic and forcible compression of the *healthy* side twice a day, during five to fifteen minutes each time, as recommended by Concato of Bologna and Albertozzi of Florence, should be tried. The compression is performed during expiration with both hands applied to the healthy side. The same method is resorted to by Gerhardt in the treatment of pulmonary emphysema, and is very serviceable in promoting absorption. The results of this method are of course more or less favorable according to the youth of the patient and the flexibility of the costal cartilages.[1]

With the same object in view Cimbali of Siena[2] has successfully practised intercostal massage in conjunction with the use of compressed air. The massage is carried out by rubbing with firm pressure the greased chest in the intercostal spaces of the affected side, from vertebral column to sternum, two or three times a day. Apart from the revulsive action on the skin, this probably exerts a directly stimulant action on the pleura.

In the way of medicinal agents the claims that have been recently presented in favor of antipyrine should not be forgotten, especially as this remedy has proved of such marked benefit in the first stage. Clement of Lyons (May 10, 1891) states that, whether fever be present or not, he at once administeres antipyrine, without any other medication whatever. In all cases there was, on the following day or at latest the day after, a marked reduction in the height to which the dulness reached. In some cases the dulness disappeared after forty-eight hours' treatment, and in two or three the fluid was completely absorbed in twenty-four hours. In no case was the effect delayed beyond four days. The dose given was, as a rule, 6 grammes (90 grains) a day—1 gramme (15 grains) every four hours. After absorption of the liquid the treatment should be continued for some days longer, in order to prevent relapse, the daily dose being, however, reduced to 4 grammes.

We have elsewhere stated that we doubted that this treatment would prove always efficacious, its value being almost exclusively limited to the truly rheumatic cases; nevertheless, the matter is too recent to be entirely dismissed without further experience.

[1] Vide *Dobell's Reports*, 1876, 1877. [2] *Lo Sperimentale*, Oct., 1885.

If in spite of the preceding treatment and better diet the effusion still lingers or increases, the value of an exclusive *milk* régime should be tested. MM. Serre, Eloy, and others[1] have claimed with some show of reason that absorption of the fluid in pleurisy can be obtained far more readily on a simple milk diet than by diuretics, drastics, and blisters. It causes a notable increase in the amount of urine excreted, and the dyspnœa decreases in direct proportion to the increased diuresis. The authors state that the milk treatment is adapted to the treatment of pleuritic patients who can afford to wait, the effect being obtainable only in four or five days. The milk may be given fresh or boiled, hot or cold, pure or mixed with aromatics, with soda, or with mineral water, but in any case the diet should be restricted to milk as a base. It should be taken by mouthfuls every hour or hour and a half, the quantity ingested in the twenty-four hours being from three to six pints. It should be continued for some days after the disappearance of the exudation, to avoid recurrence, and then the usual diet should be returned to by degrees. "Thus managed," M. Eloy asserts, "the treatment becomes one of the most powerful hydragogues destined to replace thoracentesis. In some cases the urethra may take the place of the trocar."

Notwithstanding this great praise, the present writer believes that the milk treatment is much more likely to prove efficacious in cases of simple hydrothorax due to cardiac or renal lesions, where, in conjunction with digitalis, potassium iodide, and salines, it is without doubt the dietetic article *par excellence*.

The same confidence that has been displayed in the milk treatment (*régime lactée*) in France has been given to dry diet in Germany. This dry diet, consisting of the use of *dried* food with the total suppression of liquids, is almost identical with the dietetic treatment of thoracic aneurism originally recommended by Bellingham and Joliffe Tuffnell of Dublin. In Germany, where it is referred to as Schroth's treatment, it was, and is still, adopted in many clinics through Niemeyer's recommendation. Pimser reported 11 successes in 18 cases. He limited the food of the patient to lean roast veal and stale rolls, kept him two days without any drink, and not until the third day allowed ½ a pint of red wine—on the seventh and eighth a whole pint. The urine decreases considerably under this treatment. Not many patients will have the will and the energy necessary to submit to such a cure, which, as Fräntzel says, seriously impresses the whole constitution. The writer has tried both this dietetic plan of Schroth and the less cruel one of Tuffnell in the wards of the Charity Hospital and in private practice, without results sufficiently brilliant to justify a continuance of the treatment.

[1] *Rev. gén. de Clin. et de Therap.*, Sept. 20, 1888.

It is probable that in the matter of diet much will depend upon the patient, a restricted fluid or fasting dietary being indicated for the more robust and plethoric patients, while a substantial, and even stimulating, *ménu* will be most beneficial in the poorer and anæmic class of subjects. Water in any case should be given sparingly, and preferably in the shape of milk.

In addition to the foregoing dietetic measures, the administration of a saline purgative, especially a concentrated watery solution of Epsom or Rochelle salt (1 to 3 ounces), early in the morning, as recommended by Matthew Hay, is advisable. Potassium bitartrate, compound jalap powder, and other equally vigorous purgatives may be selected, though none of them can be relied upon so much as the concentrated Epsom-salt solution first mentioned. When a very prompt and decided purgative impression is desired, probably nothing equals the following:

R. Elaterii, gr. ½;
Ext. hyoscyami, gr. j.—M.
Ft. in pil. No. 2.

Sig. Take one pill and repeat in two hours if the effect of first dose is not sufficient.

The effect of the elaterium is much improved by the combination, the hyoscyamus making it far more tolerable to the stomach and less griping.

In the way of securing elimination by diuresis the means at hand are very unsatisfactory. The potassium salts, especially the acetate, citrate, and bitartrate, spiritus ætheris nitrosi, and the vegetable diuretic infusions are so notoriously unreliable in this condition that it is almost unnecessary to disturb the patient's stomach by administering them.

The efficacy of caffeine in serous effusions of cardiac origin, now universally recognized, led MM. Huchard, Jaccoud, Comby, and others to try this drug in sero-fibrinous pleurisies.[1] In a case treated by Comby, in which 2.5 grammes of caffeine citrate, with the same quantity of sodium benzoate, were given in twenty-four hours, together with milk diet, the excretion of urine increased from 600 to 2000 grammes in the twenty-four hours, and the signs of effusion rapidly disappeared.

Doubtless, much more superior and reliable than the above for all cases in which a positive diuretic effect is desired is diuretin, or the double salicylate of sodium and theobromine (natrium theobrominum salicylicum, Merck). This diuretic, since its introduction by Gram of Copenhagen, has won for itself a very distinguished position in the diuretic group. It is certainly possessed of great energy, but, unfor-

[1] *Rev. gén. de Clin. et de Thérap.*, Apr. 25, 1889.

tunately, its efficacy is mainly displayed in the removal of those dropsical accumulations which result from circulatory disorders, especially of heart disease. Nevertheless, if any diuretics are to be tried to remove the effusion of pleurisy, this is the one to be selected. Koritschoner, Schrotter, Nothnagel, and other representative Viennese clinicians have fully sustained the diuretic value of diuretin in hydrothorax. In one case reported by Koritschoner[1] the dropsical pleura of a patient with Bright's disease was entirely drained out in the course of one night, and the evacuation was so rapid that the patient suffered as intensely as if he had been aspirated, violent cough, hæmoptysis, intense pain, and almost general collapse accompanying the sudden exit of the fluid.

The smallest efficient dose of diuretin that should be administered in twenty-four hours is 4 grammes (1 drachm); the average dose is from 4 to 6 grammes (1 to 1½ drachms), and the maximum dose 8 to 10 grammes (2 to 2½ drachms), in the course of twenty-four hours. As a rule, diuretin is well supported by the stomach, even when its administration is prolonged for months. In a patient under the author's care who had taken diuretin over three months the only disagreeable effect was a slight burning of the stomach. Koritschoner and others prefer to administer the drug in an aqueous solution. The author administers it in capsules or wafers, giving 8 to 10 grains every two hours, or 6 grains every hour, at least two hours after meals.

Much has been said in favor of the diuretic action of calomel, alone or combined with digitalis, in dropsical affections, since the earliest days when Graves and Stokes first recommended it. Nowhere has calomel—and, in fact, the whole mercurial class—received greater praise than in the treatment of serous inflammations, pleurisy in particular; and yet in no other condition does the present writer believe that it has more signally failed to sustain this unmerited reputation. This opinion is based on the recollection of the early clinical attempts to verify the reputed good results of the mercurials in pleurisy; the disastrous consequences which so frequently developed as a result of hydrargyrism soon causing the author to limit their services to the simple purgative effect of calomel.

However, the use of the oleate of mercury (10 per cent.) by inunction, or rubbed over the affected side by the massage method of Cimbali, may prove of some benefit if there is any truth in the so-called *aplastic* action of mercury on fibrinous exudations. But if it is resorted to at all, care should be taken with the mouth, the first sign of gingivitis or stomatitis calling for an immediate suspension of the remedy.

Of other remedies that may be tried to remove the sero-fibrinous exudation, we need only mention the alkalies, which, Bartholow[2] be-

[1] *La Semaine médicale*, Oct. 15, 1890. [2] *Practice*, p. 372.

lieves, are the only agents which possess the property of dissolving exudations, the most efficient of them being ammonia. Carbonate of ammonium can be best given, according to this author, in a solution of the acetate (5 to 10 grains in ½ to 1 ounce), or in the following formula if there be an associated cough with some expectoration:

℞. Ammonii carb., ℥j;
Aquæ lauro-ceras., ℥ss;
Syrup. lactucarii, ℥j;
Syrup. senegæ, ℥j;
Syrup. tolutani, q. s. ad ℥ij.—M.
Sig. One table-spoonful every two hours.

In addition to the purgative and diuretic agents previously mentioned, diaphoresis may also be resorted to with advantage by means of the hypodermic injection of ⅓ grain of any of the salts of pilocarpine. L. Michau of Paris at one time reported excellent results in the removal of serous effusion with the infusion of jaborandi. The later reports of Crequey, Grasset, Lequesne, and Wermaere would appear to sustain the value of this remedy, though a conscientious experimentation with the drug has given the author only negative and disappointing results as far as the cure of the effusion is concerned.

Our objections to counter-irritants in the advanced or chronic cases of pleural exudation have been stated elsewhere. In the earlier weeks of the effusion some benefit may be obtained from the local application of the compound tincture of iodine, fly blisters, or the use of the following very irritant solution known in the New York hospitals as Corson's paint:

℞. Olei tiglii, ℥ij;
Ætheris, ℥iv;
Tinct. iodinii comp., q. s. ad. ℥ij.—M.
Sig. To be painted over the affected part with a camel's-hair pencil every morning.[1]

Nevertheless, when the effusion, after reaching the fourth week, still resists the internal remedies and the dietetic measures previously recommended, it will not be affected by external embrocations, and the practitioner will do better by proceeding to the evacuation of the rebellious effusion by aspiration.

Thoracentesis.

For a long time, even after the introduction of improved apparatus, it was claimed that thoracentesis in pleurisy was only an emergency

[1] S. Mitchells, *Therap. Gaz.*, Nov. 16, 1885

operation, simply intended to relieve the urgent asphyxial phenomena resulting from an excess of exudation. Like tracheotomy in croup, it was the forlorn hope of an exhausted treatment. Yet as far back as the days of Trousseau we were taught that in the evacuation of pleural effusions we possessed something more than a palliative procedure, and that, in fact, it was the most effective measure given to us to promote and secure the radical absorption of serous effusions; and time has confirmed the truth of this teaching.

We may now state that the indications for the puncture of the chest and evacuation of pleural effusions are based upon—1st, the abundance of the effusion; 2d, the rebelliousness of the effusion to absorption in spite of appropriate medication.

Conditions which Demand Immediate Evacuation.—(*a*) Whenever the effusion is excessive and is accompanied by symptoms of asphyxia, such as orthopnœa, cyanosis, etc., then there is urgent danger, and the fluid must be aspirated at once. (*b*) Whenever the exudation is excessive and fills the whole pleural space, even when there are no symptoms of asphyxia, then large accumulations are dangerous, because by suddenly displacing or twisting the root of the heart, or otherwise interfering with the thoracic circulation, they may cause instantaneous death.

But what must we consider as an excessive or immediately dangerous quantity in the absence of subjective symptoms? Trousseau and Dieulafoy regarded two to two and a half quarts as dangerous; and the researches of the latter have shown that death has never been caused by quantities less than two quarts, except in the fatal case of Blachez, in which the pleura did not hold more than two quarts. By what signs can the presence of a dangerous quantity be recognized? It may be stated, in a general way, that in these cases all the respiratory sounds are replaced by absolute silence; the respiratory murmur and vocal resonance are everywhere abolished; there is complete dulness or flatness on percussion, from the clavicle in front or the supraspinous fossa behind to the lower edge of the costal arch below. The apex of the heart is displaced to the right or left; the liver and spleen are depressed; the chest is dilated; the intercostal spaces bulge; the walls are occasionally œdematous. A better test than all this is the evidence furnished by the result of a puncture with the long, fine needle of a hypodermic syringe, which will not only determine the nature of the fluid, but also decide as to the precise height of the effusion. We may safely say that in all cases in which fluid is detected on a level with the second rib immediate evacuation, irrespective of other considerations, is called for and must not be delayed.

Conditions which Permit Delay.—"With good resonance down

to the third rib, and with no material enlargement of the side, we may assume that, although much fluid be present, the lung is only held in the position of physiological rest, and that, therefore, operative interference is not called for" (Powell).

Whenever the effusion is only moderate in quantity, the indications for puncture and evacuation are only to be drawn from the resistance of the liquid to absorption. In acute pleurisy the febrile period has always been regarded as unsuitable for surgical intervention. It is always a wise plan, for the reasons given elsewhere, to abstain from interference during the febrile stage, unless a very rapid and dangerous increase in the effusion, in spite of medication, calls for symptomatic relief. Nevertheless, as Moutard-Martin clearly demonstrated, "fever has no bad effect on the final progress of the effusion, and a puncture made during its course is liable to cause a fall of the temperature to normal." Potain observed that the fever fell and disappeared completely from the second to the fifth day in 25 cases of acute pleurisy in which thoracentesis was resorted to at this early date. Widal,[1] who is an enthusiastic advocate of this practice, says: "There is nothing surprising in these results when we consider that to puncture during the febrile state is to puncture early—*i. e.* when the lung is still free from adhesions and expands easily, since it has not had an opportunity to contract incurable attachments." Behier operated, in fact, on the ninth or tenth day, the moment that defervescence took place. Webber goes still further and punctures his patients during the first week, the fever notwithstanding, and greatly extols the results obtained by this method. It is best, however, to adopt a middle course, and to operate only after complete defervescence, when, after a reasonable trial of medication and diet, it is manifest that the exudation shows no disposition to be absorbed spontaneously, and that the case will enter into a chronic stage unless relieved.

In left-sided pleurisies the course of the exudation must be watched with great care, the displacement of the heart taking place much more rapidly. Evidence of cardiac displacement should here immediately call for aspiration.

In the aged, thoracentesis is more often a palliative operation, as the pleurisies which require it are most frequently of a secondary and complicated character. Especial caution in performing the operation slowly is demanded.

The acute pleurisies of childhood rarely require aspiration unless they become purulent. The non-purulent or simple sero-fibrinous exudates are so promptly and effectively disposed of by nature that operative intervention is, as a rule, superfluous.

Whatever may be the ultimate effects of thoracentesis upon the

[1] Art. "Pleuresie," *Dict. Dechambre.*

cure of the pleurisy, the operation always secures for the patient immediate and very marked relief. As fast as the fluid is evacuated and the lung unfolds and expands, the inspirations gain in depth, the percussion notes become clearer and resonant in the anterior region of the thorax, then posteriorly, and above; if the heart has been displaced, it does not remain in its abnormal situation, but gradually returns to its proper place, provided it be not bound down by adhesions.

The auscultatory phenomena confirm the preceding data. The temperature is frequently elevated shortly after the operation: it may even attain 104° on the day of the puncture, but the next day returns to normal (Widal).

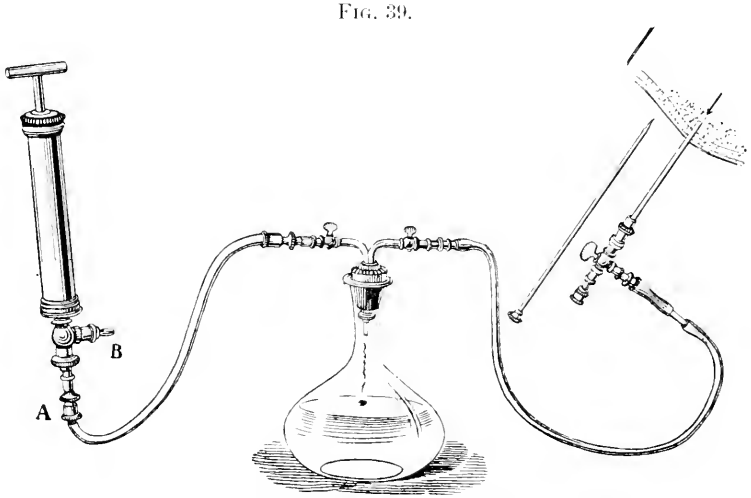
Mode of Operating.—The therapeutics of pleurisy exhibit nowhere more conspicuously the beneficent influence of modern progress than in the mechanical means that have been invented for the safe removal of the fluid products of this type of serous inflammation. In glancing over the history of thoracentesis we notice that the knife, which was first used, promptly gave way to the hot iron, and this to the trocar. This instrument, which was a deadly weapon in the hands of the older surgeons, helped, with the aid of the fatal consequences following its use, thoroughly to discredit the operation.[1]

It was not until the trocar was essentially modified by the ingenuity of Reybard that thoracentesis became a less formidable operation. The simplicity of Reybard's apparatus, and the security which it ensured in preventing the entrance of air, made it the most popular instrument for the evacuation of the pleural contents, its practical utility having been proven so continuously by the brilliant results obtained by Trousseau, to whom we are profoundly indebted for his great work in popularizing the operation and rescuing it from the disrepute into which it had fallen. At present, thanks to the introduction of the method of aspiration by Bowditch of Boston (1852), and the subsequent pioneer efforts of Dieulafoy in France, Raumussen in Denmark, and Mayne in England, and lastly to the advent of Listerism and asepsis, the operation of thoracentesis has been so perfected that it may now be regarded as a practically innocent operation. Thoracentesis is at present always performed with very fine hollow perforated needles or trocars attached to aspirators of some modern pattern. Dieulafoy's and Potain's are, in our opinion, the best aspirating apparatus yet invented, in spite of the thirty odd modifications of them

[1] "Boyer operated several times, and never saved a single case. Dupuytren had only 2 successful cases in 50. He said that his patients should die by the hand of God, rather than by the hand of man. Sir Astley Cooper had only one successful case. Gendrin not one in 20 cases. Davis saved two-thirds of his cases. The eminent W. W. Gerhard of Philadelphia looked upon the operation as nearly always attended with fatal results. What a contrast to modern views and clinical results!"—(F. Donaldson, art. in Pepper's *System*).

that have been introduced. They are nearly all worked on the same principle—the close vacuum operation, and the withdrawal of the fluid by aspiration. Bowditch employed a syringe with a double stopcock (Wyman's, Weiss's); Flint recommends the Davidson syringe. The bottle aspirators of Potain, Castiaux, or Raumussen commend themselves, especially for their simplicity and cheapness, the last a great point in favor of their general adoption. The Allen surgical pump, a recent candidate for favor in the United States, is also an admirable instrument, very ingenious, and simple in its construction. It has found many advocates, and is used extensively in the West. We have not had very extended experience with it, but presume that it can be utilized as well as the other and older apparatus mentioned. We can only say that as long as an instrument will readily secure a vacuum, can be cleansed without difficulty, and is readily transportable, it will meet all the requirements. We must, however, stop to consider one point which is common to all instruments, and that refers to the puncturing agents. All aspirating needles, unless guarded, as in Fitch's dome trocar or Castiaux's or Robert's protected point, should be rejected as positively dangerous. The point of the unprotected needle is liable to wound an expanding lung, to injure the diaphragm or pericardium, and to convert a simple pleurisy into a hæmothorax or pneumothorax. These results rarely occur in experienced hands, but they constitute a real element of danger, which can only be guarded against by using a trocar, such as has been adapted to the aspirating apparatus by Potain

FIG. 39.

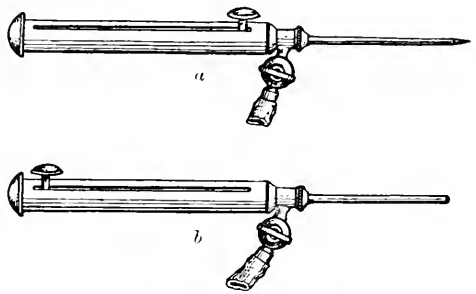


Potain's Aspirator: Galante model trocar, with stylet withdrawn.

(see Fig. 39) or Fräntzel (see Fig. 40). By the use of these trocars not only are the above dangers avoided, but what is a very great advan-

tage is gained—viz. the ability to clear the canula of any obstructing fibrinous plug without repuncturing the patient. The plugging of the

Fig. 40.



Fräntzel's Trocar: (*a*) with projecting stylet; (*b*) with stylet withdrawn.

canula in aspiration is of frequent occurrence, especially in acute inflammatory effusion, and has always constituted one of the most annoying accidents of the operation; all this is avoided by either of the trocars mentioned.

We need not refer to other methods of evacuation which have been introduced with the view of supplanting aspiration. The syphon method (Fiedler's or Southey's), which has received considerable commendation in some quarters, has been tried by the author, but with great disappointment, and promptly abandoned. It may do in simple hydrothorax, but in cases of effusion with much flocculent exudation it is simply a nuisance.

As to the subcutaneous pleurotomy suggested by Kogerer of Vienna, by which this operator expects the pleural effusion to empty itself into the subpleural connective tissue, it is of more illusory advantage than practical worth.

Having decided that the evacuation by puncture and aspiration is the simplest and the safest means of removing pleural effusion, we must now consider the *modus operandi*. The first and essential step is thoroughly to cleanse the aspirator and test its working condition. The next step is thoroughly to sterilize the trocar or needle-point. If we bear in mind that the greatest danger in the operative treatment of simple serous effusions lies in their ready contamination by the introduction of pyogenic micro-organisms through a septic or unclean canula, we will readily appreciate the vast importance of antiseptic precautions.

The best way of sterilizing the needles or trocars and canulæ of the aspirator is to boil the trocar and canula separately for twenty minutes in a solution of 1 drachm of sodium bicarbonate to a pint of water; then, after drying, keep them permanently immersed in a sterilized bottle

filled with absolute alcohol. This recent suggestion of Dawbarn of New York is of positive value, not only in keeping the instruments aseptic, but also free from rust. The plan was originally suggested for the preservation of surgical needles, but I have extended its application to much larger instruments, as in this instance.

Another plan is to wash the needle, trocar, or cannula in an alcoholic or watery solution of carbolic acid, 5 to 10 per cent., taking special care to wash the trocar and cannula separately. After washing, the needle or trocar should be heated thoroughly over an alcohol flame, and cooled by dipping in the carbolic solution just mentioned. Debove has gone so far as to invent a special sterilizing stove for his trocars, which can be heated to 120° C., but this is unnecessary. In addition to this, a warm carbolized solution (5 per cent.) should be aspirated through the tubing attached to the trocar, in order to make more certain the purification of the instrument.

Having thus prepared the apparatus, our attention should now be directed to the patient. Here, again, the first object of our solicitude should be the securing of an aseptic surface. Warm water with German green soap or the bichloride soap (Bergmann's formula) of Steifel & Co. is an excellent means of cleaning the surface. If the surface has not been irritated by blisters or counter-irritants, bathing the surface with ether and alcohol, and finally wiping with absorbent cotton soaked in a 5 per cent. carbolic acid solution, will complete the antiseptic preparation of the surface.

The next question is where to puncture. The point of election for aspirating the chest has given rise to much discussion.[1] There is no classical point of election. The selection of a site for puncture should be governed by at least three considerations: 1st. Quantity of the fluid and the height reached by its upper level; 2d. The displacement of the vital organs, especially the heart and diaphragm; 3d. Presence or absence of adherent lung.

We should also bear in mind that as we leave the axillary line, to move either forward toward the sternum or backward toward the spine,

[1] Laennec punctured the fifth interspace just above the sixth rib at a point midway between the axillary and mammary lines, or preferably near the latter. This is adopted by Fräntzel, Wolliez, P. Barbille, etc. Cruveilhier advised the third and fourth interspaces as being the points selected by nature in spontaneous evacuation. Tronsseau preferred the sixth interspace in the mid-axillary line on the right, and the seventh intercostal space on the left side; this is also Douglas Powell's selection. Professor Marshall would choose the anterior weak spot in the fifth space, nipple line. Another weak spot preferred by some operators (Beaumetz) is in the posterior axillary line, on a level with the lower angle of the scapula. Maurice Reynaud claimed that the seventh middle intercostal spaces were the columns of Hercules that guided the operator to a safe entrance into the chest. Bowditch recommends the posterior wall of the chest, as low down as possible between the ninth and eleventh ribs. Dieulafoy advises the eighth intercostal space, on a level with the inferior angle of the scapula.

the dangers of the puncture increase. The nearer we approach the vertebral column, the narrower become the intercostal spaces and the thicker the thoracic parietes. If we approach near the sternum, we are more liable to puncture the pericardium or heart, especially in the encysted or areolar pleurisies, in which the cardiac displacement is more likely to occur; and if we puncture too low, the liver or spleen may be injured. At all events, the vertical anterior or mid-axillary line is the safest; "if the fluid is excessive, we can operate as high up as the fifth intercostal space on the right side, and the seventh on the left. If the chest is two-thirds full, we can take the seventh or sixth intercostal space on the right side, and the eighth on the left. If only one-third of the cavity is occupied by fluid, we can go as low as the eighth intercostal on the right, and on a level with the scapula in the axillary line on the left side. If the quantity of fluid is so great as to force the abdominal viscera, especially the liver and spleen, below their normal position, we may be safe in puncturing below the seventh intercostal space. Aran plunged a trocar into the liver when operating in the seventh intercostal space; Claude Bernard impinged upon the peritoneum at the same point." Without being exclusive the author would advise, with Donaldson, "when there are no contraindications the sixth intercostal space in the mid-axillary line;" it is out of reach of the diaphragm on both sides, and is accessible when the patient lies on the side, which the writer prefers; the space is also sufficiently wide and the parietes thin.

In dealing with fat or œdematous walls the advice given by Professor Peter[1] is good. In these cases counting the ribs is no easy matter, and the best plan "is simply to aim at an intercostal space in the axillary line, situated at the point of junction of the lower with the upper two-thirds of the thorax."

Having now thoroughly tested and sterilized the apparatus, cleansed the surface of the chest, and finally settled upon the precise spot where the puncture is to be made, and, above all, being certain of the correctness of the diagnosis, we must proceed to the operation proper by anæsthetizing the proposed seat of puncture. This is a matter of considerable importance with many, if not the majority of, patients. The best means of effecting this is by the subcutaneous injection of 5 or 10 drops of a 4 or 5 per cent. solution of the hydrochlorate of cocaine in water. This will secure perfect painlessness in the introduction of the trocar. It is certainly more efficacious than the use of the ether or rhigolene spray or the ice-and-salt applications of Douglas Powell.

In the majority of cases when a fine No. 1 needle trocar (1 millimetre calibre) is used, no preliminary local anæsthesia is required, as the pain is trifling. General anæsthetics or analgesics, such as

[1] *Leçons de Ligne*, p. 638.

morphine, are, as a rule, not only contraindicated, but absolutely unnecessary. In some cases the patient may find comfort in a preliminary drink of whiskey or brandy. A light meal two or three hours before the operation is usually a good preliminary (Donaldson). Whiskey, ammonia, digitalis, and camphor should always be at hand to be exhibited in case of complications, especially to relieve the fainting feeling that often overcomes the patient while the aspiration is in progress.

When all is in readiness the patient should lie in a semi-recumbent position (neither the horizontal nor upright position is advisable), with the arm corresponding to the affected side bent over the head, so as thoroughly to expose the side. The skin should now be drawn up, and the nail of the left index finger of the operator should be pressed well in the interspace, so as to serve as a conductor to the aspirating trocar. The finger will better guide the penetrating instrument by pressing thoroughly upon the interspace for a few seconds, the main point to avoid being the lower edge of the overlying rib, under which course the intercostal vessels and nerves, which must be avoided; on the other hand, the point of the trocar should distinctly avoid the upper edge of the lower rib, for fear of striking the bone, and thus embarassing most annoyingly the first step of the operation. Having struck the intercostal space in the centre, the trocar or needle should be thrust boldly into the pleura with the point directed rather downward than upward, for fear of injuring the lung; the instrument should be sharply pushed in, and not thrust in with a slow, boring motion. Some authors recommend the preliminary puncture of the skin with a lancet to diminish the resistance of the surface, but this precaution is only needed when the larger needles or trocars are used.

The diminished resistance which is usually felt after a penetration of one or two inches indicates that the cavity has been reached, and that it is time to withdraw or conceal the trocar-point, and to proceed to the aspiration of the liquid proper. Upon turning the stopcock a small vacuum, created by preliminary aspiration, will immediately cause the fluid to flow into the receiving cylinder (Dieulafoy's) or bottle (Potain's) of the apparatus used. As the fluid flows the aspirating force should be only sufficient to draw it out slowly and gently. It is well to stop for a few minutes after aspirating about four ounces to watch the effects. "The fluid, running in a very small stream, will give the lung time to accommodate itself to its altered condition. The lung by this process is led rather than forced to resume its normal position" (Donaldson).

It often happens, particularly when aspirating the effusion of acute pleurisy, that large fibrinous coagula obstruct the canula, and that the flow of the fluid is arrested. Here the advantages of using the trocar

of Potain or Fräntzel become manifest: the stylet or trocar, which has not been wholly removed, is carefully pushed in again and the cannula cleared of the obstructing embolus. Beaumetz and others object to this secondary use of the trocar and prefer to repuncture the chest, on account of the supposed danger of air-contamination; but with a well-constructed trocar like either of those recommended the admission of air can be surely guarded against, and the inconvenience and pain of a new puncture avoided. Clearing the cannula by forcing back a regurgitant current from the aspirator, as recommended by Bowditch and others, is even more dangerous, because the fluid already aspirated may be the carrier of some particles of septic or unclean matter concealed in the tubing or aspirating receptacle.

Having begun to aspirate, the next question is to determine when to stop the aspiration. The amount to be withdrawn must vary according to many circumstances peculiar to each case. "Our rule," says Donaldson, "has been to draw off more when the pleurisy is acute than when it is chronic. The long continuance of the fluid in the cavity has so impaired the lung's capability of expansion by the adhesive bands that compress it that the sudden withdrawal of a large quantity is often attended with risk. If the patient bears the operation well, we may remove much more than if the contrary is the case. The amount withdrawn at the first operation should be from eight ounces to sixteen ounces in a child, and twelve ounces to twenty-four ounces in an adult." The complete evacuation of the pleura is not necessary. A partial evacuation, to start the absorbents into activity by diminishing the excessive intrapleural tension resulting from excessive fluid, is all that is required.

With the object of obtaining precise data as to the amount of intrapleural tension during thoracentesis, and thereby regulating the quantity of liquid abstracted, many clinicians have adapted the manometer to their aspirating apparatus. Preference should be given to the simplest models, such as Peyrot's and Leyden's. The manometer allows the observer to follow directly the rate of tension-reduction and the degree of aspiration, and in this way avoid those ugly and at times fatal accidents which follow the too rapid or sudden diminution in the intrapleural tension. Potain has laid down the rule that the aspiration must be stopped whenever the manometer indicates that the intrapleural tension is inferior to that of the atmosphere. We believe, however, with Schreiber and almost all observers, that "the manometer only complicates the operation without sufficient compensatory advantages, and that the physiological phenomena which promptly indicate the existence of dangerous tension-reduction are even safer indices than the manometer," and for this reason we need not dwell further upon it.

One point is of the utmost importance: the needle should be instantly withdrawn at the onset of dyspnœa, chest constriction, much cough, or any tendency to syncope. These symptoms are warnings we should never neglect. This is the time to administer stimulants.

After the removal of the desired quantity the needle is withdrawn with a sharp, quick pull. The skin is allowed to fall and obliterate the track of the puncture, and the orifice of the latter is closed with either a small strip of adhesive plaster or a little cotton pledget soaked in iodoform collodion (5 per cent.)[1]

Complications and Dangers of the Operation.—The simplicity and benignity of modern aspiration, whenever practised with ordinary precautions, are so amply proven by experience that no statistical evidence need be quoted to prove a fact so universally admitted. Suffice it to say, that in a practice of over ten years' duration in the wards of the New Orleans Charity Hospital—an institution which annually ministers to the ills of over 20,000 patients—and in which the puncture and aspiration of the pleura was probably performed over one hundred times a year, I have never witnessed or heard of a fatal accident occurring during its performance. That complications and ugly symptoms do present themselves quite often during the operation is undeniable, especially when aspiration is pushed to extremes by an over-zealous or inexperienced operator, who, not heeding the warnings of the patient, rashly carries his efforts at complete evacuation to unnecessary and dangerous limits.

Among the accidents of thoracentesis we should mention—*a*, injury to the intercostal vessels; *b*, injuring the rib; *c*, puncture of the liver, spleen, heart, and lungs; *d*, plugging of the needle or trocar with fibrinous coagula, causing "dry" puncture or failure to aspirate; *e*, admission of air; *f*, cough-paroxysms, due to pulmonary fluxion; *g*, constrictive thoracic pains, due to eccentric distension of pleural and pulmonary adhesions and painful concentric retraction of thoracic walls.

The more specific complications which at times very seriously encumber this simplest of operations are—

Albuminous Expectoration.—This accident may vary in intensity—

[1] With the view of preventing reaccumulation, Drs. Cayla, Picot, and Gourichon (*Journ. de Méd.*, Paris, May, 1885) have recommended that aspiration should be immediately followed by the systematic application of the thermo-cautery over the affected surface. The cauterizations should be very numerous, from one to two hundred, and not be distant from one another more than half an inch, and they should always extend beyond the limits of the pleural effusion. They should be made by simply touching a pointed hot iron to the skin, so as to make a minute cauterized point.

The method proved particularly beneficial in the acute and early cases, which, as a rule, do well under simple aspiration. In the chronic cases it has apparently given fair results. While little confidence can be placed in it, nevertheless it is worth remembering in the treatment of the obstinate chronic cases, as we shall see later.

very insignificant at times, very serious at others. In the first instance the patient may be seized by a paroxysm of cough and thoracic oppression followed by slight serous or sanguinolent expectoration, which may end in five or ten minutes. In the more dangerous examples of this complication the cough is paroxysmal, the anxiety and cyanosis increase, and the patient expectorates mouthfuls of a serous liquid which may vary in quantity from two ounces to two quarts. The liquid expectorated, on settling, separates into two strata—the upper frothy, and the lower showing an albuminous precipitate. Auscultation reveals the fine crepitant râles of œdema at the base of the lungs. The suffocation and dyspnœa attending this last condition may last a few hours or a whole day. In some cases, fortunately very rare, this untoward complication ends in death.

This accident is not due, as was at first supposed, to a formation of a pleuro-bronchial fistula, permitting the escape through the mouth of the pleural exudation (Fercol), but, as demonstrated by Herard, Moutard-Martin, and Dujardin-Beaumetz, it is due to pulmonary congestion; sometimes it may be due, as Legroux and others contend, to the cerebral and bulbar anæmias which are the consequence of the great afflux of blood to the compressed lung which is being relieved from pressure by the aspiration. In order to avoid this congestion and its consequences Dieulafoy has given this well-known and excellent advice: Never to withdraw at one aspiration more than 1000 to 2000 grammes of liquid, especially if the pleurisy is an old one. By following the advice already given in the preceding pages while dealing with the technique, this accident will rarely, if ever, occur. It is a notable fact that in the last few years, since the technique of the operation has been better understood, deaths from this complication are seldom recorded.

The medical treatment of this complicating congestion consists in the exhibition of stimulants, counter-irritants, and derivatives, particularly venesection, the efficacy of which has been proven more than once.

Sudden Death during Aspiration.—The cases of sudden death due to syncope or asphyxia which have been reported as occurring in the course of thoracentesis exercised at one time a discouraging effect upon the practice of this operation. The rigorous analysis of the facts, and the special study of the individual cases by such conscientious investigators as Leichtenstein, Bowditch, Toussain, Dieulafoy, and Donaldson, have proved conclusively that these unfortunate results were not attributable to the operation itself, but to the conditions under which it was practised.

Conditions of the Lung following Aspiration, and their Treatment.—Three things may happen after the partial or complete evacuation of the pleural contents: 1st. Immediate cure by the com-

plete absorption and non-reproduction of the effused fluid. 2d. After a partial evacuation the remaining fluid may be more or less rapidly reproduced, to be again absorbed never to return. 3d. The liquid evacuated may be again replaced by new exudation. The first two results may be invariably depended upon, and characterize the course of acute, simple, and uncomplicated or primary pleurisy when treated by early aspiration. The third class of cases, which are characterized by a rapid reproduction of the effusion, demanding repeated evacuation, are only observed in chronic pleurisies, and are, as a rule, indicative of a complicated condition, tuberculosis of the pleura being the special etiological factor to be suspected. We must also observe, in most of these cases in which the effusion is reproduced with great rapidity and abundance, that not only tubercle is to be suspected, but the advent of suppuration *is to be anticipated*.

Chronic Pleuritic Serous Effusions.

Not a few cases are still from time to time met with in which one side of the chest is distended with fluid, the effusion dating from an attack of pleurisy months, or even a year, previously, and which, on removal, proves to be perfectly limpid and serous. This is particularly observed in cases of so-called latent pleurisy. Douglas Powell relates an interesting case of a policeman, "stalwart-looking enough to frighten thieves," who for over four or five years had his left pleura completely full of slightly turbid serum. After a few partial tappings it became evident that no expansion of the lung could be looked for, and in the absence of urgent symptoms it was not thought prudent to subject him to radical treatment. Powell, with Wilson Fox, does not believe that an effusion will become purulent from mere lapse of time, but the author concurs with many others that, in view of the existence of many avenues of infection and the readiness with which pyogenic micro-organisms may contaminate an originally strictly serous exudation, there is always danger of purulent transformation in these chronic cases. Furthermore, it is well recognized that perfect recovery in the very long standing cases is well-nigh impossible by resorting to simple operation, the lung having become bound down and thickened by long-continued compression. With Powell, again, the author believes that there will always be a certain small number of cases in which the lung is from the first coated by an exudative layer of unusual thickness and uniformity, which, as pointed out by Walshe, contracts forcibly and aids the fluid in bringing about collapse of the lung. Such a membranous layer affords a serious impediment to absorption, and is apt to undergo a degree of organization which renders the contraction of the lung a permanent condition. Under these circumstances, and in a strongly-built adult chest (as in the case of the policeman above quoted),

a large pleural space remains which it is almost impossible to obliterate, and which must be occupied by some kind of effusion.

What should be the conduct of the medical adviser when confronted with such a case? When the contained fluid has undergone purulent transformation or is primarily purulent, the operative relief that surgery would prescribe is clear. Estlander's operation or Schede's thoracoplasty would solve the problem in some measure by allowing the chest-walls to sink in, and secure the obliteration of the cavity. But when the effusion is still serous, are we justified in resorting to similar procedures? The question has not been sufficiently debated to permit us to generalize and establish a guiding rule of practice, but, believing that the presence of fluid in the chest would always be a menace to the life of the patient, either by its liability to sudden increase, its purulent transformation, or by its effect upon the lung, we would advise aspiration, followed by the subperiosteal resection of several ribs, as has been done by Dr. Westbrook of Brooklyn[1] for this very condition. This is a safe operation, for it would not open the pleura to infection, since the ribs would be resected subperiosteally.

We may state, in a general way, that the cure of pleurisy is never complete: after the evacuation of the fluid the primitive friction-sounds indicative of the approximation of the pleural surfaces are heard. These finally disappear, and with their cessation we are informed of the occurrence of the adhesions which intimately and permanently bind together the parietal and the visceral pleuræ, thereby obliterating the pleural cavity proper.

Against these pleural adhesions, whether they be secondary to a sero-fibrinous pleurisy or they be primary, as in the so-called "dry" pleurisy, the materia medica has little to offer. The secondary revulsives, blisters, iodine, and the internal exhibitions of mercury and the iodides, which have been advised, are mere placebos, the use of which is usually followed by disgust and disappointment to both patient and physician.

Much more satisfaction will be found in carefully attending to the general hygienic and dietetic conditions. A course of systematic respiratory gymnastics, general and local massage, will prove practically beneficial for the correction of the deformities of the thoracic and vertebral skeleton, which not only disfigure the chest, but encroach upon the respiratory capacity of the patient.

The use of compressed air by means of the pneumatic cabinets now in use in this country, or a course of mountain-climbing, will probably give the best results in securing the final restoration of the lung itself and the nearest possible approximation to its normal expansion.

[1] *N. Y. Med. Jour.*, March 12, 1887.

Varieties of Pleurisy.

While the fundamental indications in the treatment of all forms of non-purulent pleuritic inflammations are well covered by a thorough appreciation of the therapeutic principles laid down in the body of this article, there are nevertheless such distinct departures from the typical pleurisies which have been here considered that a brief notice of the most marked and eccentric variations is necessary.

TUBERCULAR PLEURISY.

First in order of importance is tubercular pleurisy. We must distinguish between primary tubercular pleurisy and that which develops secondarily as a result of extension from the lung. Primary pleural tuberculosis may be localized or disseminated. If localized, it will usually present the characteristics of "dry" or plastic pleurisy, rarely developing into the typical sero-fibrinous type. If, on the other hand, the deposits are multiple, then a sero-fibrinous pleurisy will develop, which will be most difficult to differentiate from the typical *a frigore* or non-tubercular variety. There is no doubt that this form of tuberculosis is exceedingly common; certainly much more so than was taught some years ago. The frequency with which tubercle was found in the anatomical and clinical researches of Landouzy, Kelsch, and Vaillard led to the generalization that all idiopathic primary pleurisies were of tubercular origin. While the contention of these investigators is far from being proven, it nevertheless indicates the vast importance of this variety, and the care that must be exercised before concluding as to the nature of even the simplest cases that come to us for treatment. It is not always an easy matter to establish conclusively the tubercular or non-tubercular origin of a given case of pleurisy. Much was expected from bacteriological research since Koch's discovery of the bacillus, and still more from the diagnostic reaction of his tuberculin. The real blessing that would have been conferred upon us by the last has unfortunately proved an illusion; and as to the test presence of the tubercle bacillus in the secretions—a test which is so valuable in other localities—it is also denied us. The recent researches of Fränkel, Weichselbaum, Ehrlich, Netter, and Koplik prove that in the vast majority of cases of exudative pleurisy in which the clinical facts would suggest the presence of the bacillus this micro-organism is conspicuous by its absence. Therefore, in the absence of the actual demonstration of the bacillus, we must depend solely upon the lessons of experience, which teach that all pleurisies in which this effusion constantly and rapidly returns after aspiration, and in which the aspirated fluid presents a sanious character, must be regarded as due to tubercular deposit.

In marked contrast with the failure of bacteriology to furnish a diagnostic test is the valuable assistance furnished by physical signs; not in the primary pleurisies proper, but in those secondary tubercular pleurisies which are developed early and coincidently with the first deposits in the pulmonary parenchyma. Thanks to the later studies of Grancher and his followers, which are familiar to all students of physical exploration, the presence of tubercle in a lung surrounded by even a large exudation can be detected with comparative ease.

The recognition of this last condition now opens the question as to the attitude of the practitioner in a case in which a large effusion compresses a tubercular lung. The question is a difficult one, and has not been satisfactorily answered. Powell[1] states: "As long as a chronic effusion does not give rise to any serious displacement of other viscera or to danger symptoms, it should be preferably left undisturbed." We believe, however, with Beaumetz and others, that when the effusion is recognized early, the expansion of the lung, which is secured by prompt aspiration, is more likely to restore the lung to a better physiological condition, thereby assisting Nature in preventing the further evolution of the disease in the lung.

While the effusion in tubercular pleurisy is more frequently clear and strictly serous or *sanious*, it may become purulent or puruloid at the least provocation, either through contamination with pyogenic micro-organisms or through the superficial necrosis of the granulation membrane. This superficial necrosis of the granulation membrane, as Kelsch and Vaillard have shown, is a frequent cause of intrapleural hæmorrhage; in fact, tubercle by this process is one of the most frequent causes of hæmothorax. Generally, however, the hæmorrhage in these cases does not exceed 800 or 1000 grammes (Vidal), and is often the precursor of ultimate purulent changes. At any rate, as Dieulafoy and others have shown, the removal of the effused blood by aspiration leads often to permanent cure of the pleurisy.

Finally, in the chronic tubercular cases, in which the lung is hopelessly bound down by adhesion, and which remain unaffected by aspiration, and in which the patient's general condition is good, it is possible that curetting the pleura or resecting the diseased membrane, together with tamponing, as has been done successfully by Schede and Kuester, may be the only means of securing radical relief. As far as the medicinal treatment is concerned, it is the same as that recommended for pulmonary tuberculosis.

RHEUMATIC PLEURISY.

In striking and agreeable contrast with the preceding is the rheumatic type, which is essentially characterized by the rapidity of its

[1] Third American edition.

appearance and disappearance. It may assume the very acute plastic or the subacute sero-fibrinous type, but in any case it rarely becomes chronic. The vigorous administration of the analgesic antithermics, antipyrine, phenacetin, acetanilide, or salol, or the salicylates, with morphine, promptly relieves the most acute symptoms and ensures very satisfactory relief. If there is some stubbornness to absorption of the exuded serum in the later stages, potassium iodide, with the syrup of the iodide of iron and arsenic, and slight counter-irritation, will usually accomplish the desired results. A favorable formula is—

℞. Potassii iodidi, ʒij;
Syrup. ferri iodidi, ʒiij;
Liq. hydrarg. et arsenii iodidi, ʒj;
Syr. avenæ phosphatis, *vel* syr. zingiberis, q. s. ad. ʒviij.—M.
Sig. Table-spoonful three times daily for an adult.

HÆMORRHAGIC PLEURISY.

This is never a primary or specific type of pleural inflammation, but is a secondary epiphenomenon which is frequently added to other more distinct and independent varieties of pleuritis, and as such is of sufficient importance to deserve separate consideration. If the word "hæmorrhage" were translated in a literal sense, all acute pleurisies would be hæmorrhagic, because almost all the exudations of acute pleurisy contain a considerable number of red blood-corpuscles. A serous effusion may contain as many as six thousand red cells to the cubic millimetre of effusion, and still this will remain perfectly limpid to the naked eye (Dieulafoy). If the number of cells increases, however, the liquid will become rose-tinted, and finally blood-colored. The difference between the two will simply be that the first is only a histological hæmorrhage, while the last will be grossly or clinically a true hæmorrhagic extravasation. This difference is also of prognostic and therapeutic importance, for, as shown by Dieulafoy, a *histologically* hæmorrhagic pleurisy will almost invariably become purulent, while a true hæmorrhage into the pleura or into a serous effusion consequent upon secondary causes (tubercle, cancer, etc.) never becomes purulent.

With Widal, the chief causes of inflammatory hæmothorax may be grouped into—1st, an exaggeration of the inflammatory (hyperæmic) phenomena in certain acute sero-fibrinous pleurisies; 2d, hæmatoma of the pleura; 3d, pleural tuberculosis; 4th, cancer of the pleura; 5th, certain general systemic conditions; 6th, too violent aspiration during thoracentesis.

In the variety of hæmorrhagic pleurisy which is indicated by the first cause the hæmorrhage is due to the rupture of the pleural capillaries under the strain of excessive inflammatory fluxion. This is the

only condition to which the designation of primary hæmorrhagic pleurisy is strictly applicable. In these cases the exudation is rose-tinted, and finally blood-colored, from the very start, differing in this way from those sero-fibrinous pleurisies in which the exudation is clear and still histologically hæmorrhagic. In the first instance, when the hæmorrhage results from the great intensity of the inflammatory action, the prognosis is good, because the effusion is almost invariably absorbed spontaneously, and recovery takes place early; in the other variety purulent transformation, as previously stated, is the rule.

Pleural tuberculosis may give rise to hæmorrhagic pleurisy in two ways—by the degenerative or ulcerative changes of the granulomatous deposits of acute miliary tuberculosis, but much more commonly by the superficial embolic granulation necrosis of Kelsch and Vaillard, which has been referred to in the section on Tubercular Pleurisy. In addition to all tubercular infection other forms of pleurisy may give rise to hæmatomatous exudation, just as hæmorrhage may occur in pachymeningitis cerebralis or spinalis, and in hæmatocele of the tunica vaginalis.

Cancer is likewise a frequent (according to the older authors the most frequent) cause of pleural hæmorrhage. But we need not linger longer on these etiological conditions; suffice it to say that, as a rule, the majority of hæmorrhages which complicate the inflammatory affections of the pleura are either spontaneously absorbed or permanently removed by cautious aspiration. Internal treatment, especially directed to control the hæmorrhage, is very seldom, if ever, required.

URÆMIC PLEURISY.

This condition frequently develops in the course of chronic renal disease, and is of toxic origin. While it is inflammatory in character, and should be distinguished from the simple dropsy of the pleura that frequently accompanies this morbid condition, the treatment is essentially the same as in hydrothorax. It is mainly eliminative. Saline purgatives, especially Epsom salts (Matthew Hay's method), the saline diuretics, pilocarpine, and digitalis, are especially indicated. Diaphoretics will also give great assistance. Iodine as a counter-irritant may be applied, but blisters or cantharidal collodion are entirely contraindicated. The general tonic and dietetic treatment of renal disease is of course of primary importance.

CARDIAC PLEURISY.

This variety has been especially studied by Bucquoy. It is not to be confounded with the double hydrothorax that occurs in the later or anasarcous stages of heart disease. This condition is more often connected with aortic lesions, is a truly inflammatory condition, and

accompanies the earlier stages of heart disease. Its treatment is the same as that of ordinary primary pleurisy, though it is in the main subordinated to the general and graver condition which underlies it.

PLEURISIES OF UTERO-OVARIAN ORIGIN.

The intimate lymphatic connections which exist between the pleurae and peritoneum not infrequently lead to the apparent metastatic production of inflammatory affections in the pleura when these exist in the pelvic organs. These forms of pleurisy may result, as shown by Potain, from direct or lymphatic contamination or by reflex fluxion. As a rule, they are limited to the same side as the affected ovarian region; they are usually of a subacute character, and the exudations are absorbed spontaneously. Denons has also called attention to the coincidence of frequent serous effusions with large ovarian cystomata. These effusions are more probably of a dropsical than inflammatory character. At any rate, they disappear with the removal of the disease.[1]

PRIMARY SYPHILITIC PLEURISY.

This very rare manifestation has been recently described in an instructive study by Nikouline of Moscow.[2] The history of the case, and the fact that the pleuritic manifestations, exudation, etc. prove rebellious to all other than antisyphilitic treatment, are the only means of diagnostic differentiation. In the cases reported by Nikouline, potassium iodide, with mercury, produced a very marked effect in the temperature, and caused a rapid disappearance of the friction-sounds, etc.

DIAPHRAGMATIC AND OTHER LOCAL PLEURISIES.

The influence of the region involved is nowhere better exhibited than in diaphragmatic pleurisy. This condition, which was at one time regarded as an independent entity and designated by the terms phrenitis or diaphragmitis (Lieutaud, Cullen, Stoll, Portal, Frank, and others), is characterized by the development of pain and dyspnœa of peculiar intensity, and which finds no analogy in other pleurisies. The pain occupies either the right or left hypochondrium, and radiates toward the epigastrium. The pain is at times very acute, and is markedly aggravated by inspiratory movements as well as by pressure in the painful regions. M. Gueneau de Mussey's *bouton diaphragmatique* is, like McBurney's point in appendicitis, a helpful associate sign. This painful point is situated in the epigastrium at the point of intersection of two lines, one horizontal, beginning at the osseous tip of the tenth rib, and the other vertical, which is continuous with

[1] Widal, *loc. cit.*

[2] *R. Medicina*, Dec. 28, 1890.

the right border of the sternum. Very painful singultus and very intense dyspnœa, with freedom from physical signs, complete the diagnostic sketch of this formidable condition.

The only means of relieving the patient's profound distress is by the free exhibition of morphine hypodermically in $\frac{1}{4}$- or $\frac{1}{2}$-grain doses, repeated every two hours until the symptoms are subdued. Counter-irritation by blistering is also in order, together with the internal exhibition of antipyrine, antifebrin, or phenacetin. The application of the restraining band of Otto, if the painful state of the lower chest will permit it, is indicated. The band should be applied low down, to favor thoracic respiration and diminish the abdominal and diaphragmatic movements.

INTERLOBAR PLEURISY.

Interlobar pleurisy is most frequently secondary, and simulates pulmonary abscess. The exudation usually becomes empyæmatous, and finds its way out through the bronchi. The breath is markedly fœtid if evacuation by the bronchial route takes place, and the aromatic deodorants—as eucalyptol, menthol, or thymol—are indicated, both by inhalation and by hypodermic injection, dissolved in oil of vaseline or hot olive oil, as recommended by Roussel in phthisis. A good inhalant is the following:

℞. Creasoti, ℥ij;
Menthol., ʒj;
Eucalyptol., ʒj;
Chloroformi, ℥ij:
Aquæ Cologniensis, ℥ij.—M.

Sig. Thirty drops to be inhaled from a Welch or Yeo respirator every two or three hours.

This will do much good if associated with proper internal treatment, especially creasote, terpin hydrate, terebene, cod-liver oil, etc.

ENCYSTED PLEURISY.

The encysted pleurisies, which have been so well studied by Jaccoud, are characterized by very marked displacement of the internal organs, the heart especially, in those accumulations which occupy the anterior half of the left pleura. Aspiration in these cases is not followed by the best results, the effusion returning rapidly. In aspiration great caution should be observed not to puncture the displaced organs (the heart particularly), as has happened in several well-authenticated cases (Guirginshon, Dieulafoy). Experience appears to be in favor of counter-irritation preventing recurrence of effusion. Not only blisters,

but the potential and actual canteries, as applied by the ancients (Broussard, Monneret, Larrey), may be followed by surprising results, according to the trustworthy evidence of A. Martin and Professor Peter.

EMPYÆMA, OR PURULENT PLEURISY.

THE advent of suppuration in the pleura implies a radical change in the whole nature, as well as therapeutics, of the pleuritic process; furthermore, with the recognition of pus in the pleura the pharmacological resources of medicine must retire to the background, and the aggressive intervention of surgery must dominate in the treatment. For this reason a separate consideration of this variety of pleurisy is essential.

Etiology is much more intimately connected with the treatment of the purulent than with the non-purulent pleurisies. In the non-purulent varieties the inflammatory reaction of the pleural serosa is limited to plastic and serous transudation and new tissue-formation. In the purulent variety, in addition to these three conditions, there is a progressive shedding of embryonal endothelial elements, which, with the migrating leucocytes and other formed elements of the blood, constitute the pus of the exudate. Modern bacteriological investigation has almost conclusively determined that this *progressive* suppuration is solely due to the irritation of pyogenic bacteria and their products. This, therefore, is the cardinal difference between the purulent and non-purulent forms. While many of the non-purulent forms are due to pathogenic micro-organisms which are not pyogenic, the presence of pus in the pleura must always coincide with the presence of pyogenic bacteria or of both species (mixed infection).

Again, while all purulent pleurisies are of microbial origin, the bacteria which cause them may be of different species, and, being endowed with specific properties, they cause likewise different manifestations of their activity in the pleura.

With some insignificant exceptions, bacteriology has classified purulent pleurisies into at least four distinct varieties: 1st, those due to pneumococci (*Diplococcus pneumonicus*, Fränkel and Weichselbaum); 2d, to the *Streptococcus pyogenes;* 3d, those due to saprogenic organisms; 4th, those due to Koch's bacillus.[1]

The following figures indicate the relative frequency of these four great species: Pneumococcus pleurisy (usually metapneumonic pleurisy), 32 in 109 cases, or 29.5 per cent.; streptococcus pleurisy, 51 in 109

[1] *Vide* Netter, *Transact. Soc. Méd. des Hôpitaux*, May 16, 1890; *La Semaine médicale*, May, 21, 1890.

cases, or 46.8 per cent.; saprogenic or putrid pleurisy, 15 in 109 cases, or 13.7 per cent.; tubercular pleurisy, 12 in 109 cases, or 11 per cent. Netter estimates that over two-thirds of all empyæmas are due to infection with pneumococci and the strictly pyogenic micro-organisms. The statistical observations of Rosenbach, Weichselbaum, Fränkel, Renvers, and Koplik confirm the preceding studies.

The pleurisies due to pneumococci are most frequent in children, the streptococci species in the adult. In children Netter observed that 53.6 per cent. of the cases were due to pneumococci, and 17.8 per cent. to streptococci; in adults 53 per cent. were due to streptococci, and 17.3 per cent. to pneumococci.

The prognostic as well as operative indications furnished by the different micro-organisms are important. The pneumococcus is a comparatively benign organism, and has no progressively destructive or pyogenic tendencies. Consequently, the empyæmas with which it is associated are the most amenable to treatment. The metapneumonic pleurisies are almost invariably due to pneumococci. So are the empyæmas of childhood. In these cases, aspiration is sufficient, or, in the event of failure by this means, antiseptic pleurotomy will almost invariably be followed by prompt recovery.

The empyæmas that are associated with the streptococci and staphylococci have a progressively destructive tendency. They are never spontaneously absorbed, and always require free pleural incision and drainage, with careful antiseptic precautions. These agents frequently contaminate primary pneumococcal and tubercular pleurisies, and add to them their progressively destructive tendency. They are the chief mischief-makers in the acute purulent pleurisies which complicate scarlet fever and the other exanthemata, osteomyelitis, pyæmia, etc. In saprogenic or putrid pleurisies the aseptic pleurotomy with evacuation is by itself insufficient, and antiseptic irrigations are mandatory.

The positive diagnosis of the species of pleurisy is made by bacteriological examination. It requires no more than three days at furthest for the examination of the non-tubercular varieties. It may be delayed much longer in the tubercular varieties when the simple morphological examination does not reveal the presence of Koch's bacillus, which is, as a rule, recognizable only in 1 out of 4 cases, according to Netter's and Fränkel's experience. The very fact, however, that in a purulent exudation microscopical examination reveals the absence of micro-organisms is the best *prima-facie* evidence of its tuberculous character. If an absolute diagnosis is required, however, then, in the absence of the bacillus, the inoculation test practised on guinea-pigs is the only *positive* way of demonstrating the tubercular nature of the exudate.

In view, however, of the difficulty at times of obtaining a bacteriological examination, the gross appearance of the pus, coupled with the

previous history and other antecedents, will usually permit the attendant to come to an approximate conclusion as to the exact nature of the exudate. We may thus distinguish, with Germain Sée—

1st. A fibrino-purulent exudation. This liquid has a large quantity of fibrin in suspension, in the shape of either flocculi or pseudo-membranes. It has a slightly greenish tinge, and is more puruloid or puriform than strictly purulent. This exudate characterizes the true metapneumonic pleurisies and the infantile pleurisies. It is associated mainly with the pneumococcus. It will become thicker (more purulent) if staphylococci and streptococci develop in it.

2d. A sero-purulent exudate. This is the pus that is found in the empyæma of the infectious diseases or in consequence of contamination of an originally strictly serous effusion with a septic or unclean instrument. It may be faintly turbid or of a greenish creamy color; it may also be chocolate-colored when there is a great admixture of red corpuscles. This kind of pus is always associated with the strictly pyogenic micro-organisms already mentioned.

3d. The putrid and gangrenous varieties are recognized easily enough by their odor and appearance.

4th. The tubercular pus is not always so easy to identify, especially when the pyogenic micro-organisms are mixed with the tubercle bacillus in the pathogeny. In the unmixed varieties the pus has precisely the same sanious, watery appearance that characterizes the exudate in ordinary *cold* abscesses.

While the nature of this contribution and the limitations of space will not permit us to enter into a discussion of the mode of entrance of these micro-organisms into the pleura, it follows from the anatomy of this serosa that, except in penetrating wounds, its infection must always be secondary to other pre-existing microbic contaminations, whether these be localized in the lungs or other tissues, or in the blood. At any rate, the important practical question presented for consideration is how to recognize the presence of pus in the chest, in order that we may deal with it in accordance to the etiological and clinical indications. In the majority of the cases the symptoms and physical signs do not differ materially from those of fibro-serous pleurisies. Sometimes, however, they do, and this is according to whether they are acute purulent or chronic purulent pleurisies. In acute purulent pleurisy the disease commences in the same way as the ordinary acute fibro-serous pleurisy. Indeed, the first effusion is ordinarily serous in appearance, and afterward becomes purulent. A marked characteristic is that in acute purulent pleurisy the fever persists in spite of treatment; the effusion increases, sometimes less rapidly than in the serous variety, but in a continuous manner. If exploration with a hypodermic needle is performed about the eighth or tenth day, we notice that the fluid is opales-

cent and contains a large quantity of pus. If the fluid is aspirated, it is subsequently reproduced, and as the pus forms the fever continues; the skin is hot and dry, the appetite impaired, and sweats appear during the night. In examining carefully the thoracic walls we find œdema of the affected side. Later on there will be œdema of the lower extremities.

Chronic purulent pleurisy is marked by symptoms somewhat different. It commences in a similar manner to acute pleurisy, with fever, but in a few days the fever disappears. In the evening there may be some febrile action with slight chills. It is remarkable that frequently vast collections of purulent fluid do not give rise to chills. The fluid augments progressively, sometimes slowly; often it appears stationary for a long time. This condition continues sometimes for months. The patient is pale and feeble. Increasing dyspnœa interferes with locomotion. Anorexia is complete. Anæmia is most marked. Œdema of the chest-walls, followed by diarrhœa and general anasarca, with or without albumin in the urine, appears. If Nature does not open an orifice through the parietes of the chest or through the bronchi for the discharge, the patients finally succumb in the last degree of wasting, with profuse sweats and fœtid colliquative diarrhœa.

Baccelli's sign—the non-transmission to the ear of the whispered voice through the chest-walls (aphonic pectoriloquy)—is probably one of the most important physical signs of purulent transformation. This sign is, of course, only added to all the other signs of fluid effusion which are furnished by physical exploration, and which are referred to in the section on Sero-fibrinous Pleurisy.

But the positive diagnosis always rests on demonstrating the presence of pus by exploratory puncture with an ordinary hypodermic needle. Frequently, however, the hypodermic needle is too small for the purpose, especially in dealing with the thicker exudates, like those which are found in the metapneumonic empyæmas, and the larger needle of an exploring syringe is required.

In exploring the chest for diagnostic or therapeutic purposes it should be borne in mind that the needle should be inserted in a direction corresponding to the centre of the intercostal space, consequently in an oblique direction from below upward. If no contraindications present themselves, the exploratory puncture should be made at a place where, later, the radical operation will be performed, if this should be finally required. If the needle is made aseptic by the precautions given in the section on Thoracentesis, no harm will result from not merely one but many explorations, even should the lung or liver be punctured.

Presuming that the diagnosis of empyæma has been made, the three leading therapeutic indications to be met are—1st, to evacuate the pus already formed; 2d, to prevent the reproduction of another accumula-

tion; 3d, to restore as quickly and completely as possible the normal condition (anatomical as well as physiological) of the respiratory apparatus.

As a rule, the first of these indications requires surgical intervention. Spontaneous absorption, it is true, may be produced under certain circumstances: it is not even rare in the metapneumonic pleurisies, when the inflammation is due exclusively to pneumococci. But whenever other pyogenic micro-organisms (streptococci, staphylococci, and tubercle bacilli) participate in the pathogenesis, it is impossible for spontaneous resorption to take place, owing to the resistant vitality of these pyogenic agents. It is mainly owing to the complicating presence of the latter that empyæma owes its progressive character; and it is, as a rule, indispensable to interfere by operation.

As previously stated, internal medication is totally powerless in the presence of empyæmatous accumulations, experience having demonstrated more than conclusively that all the reputed sorbefacients or resorbents are absolutely worthless for the purpose. The spontaneous cystic encapsulation of the pus, which at times renders its presence less dangerous, is a rare event, and, on the other hand, the spontaneous evacuation of the pus may be followed by the most serious consequences, no matter by what route effected. Therefore, all thoracic pus-accumulations demand evacuation by surgical means.

The second indication—*i. e.* to prevent the reaccumulation of the pus—can only be met by operative procedure, which will permit the constant and thorough discharge or drainage of every particle of the old and new pus-formations.

The third indication, which calls for a *restitutio in integrum* of the anatomical and physiological conditions, remains still a desideratum in many cases. This is particularly the case with patients in whom the lung suffers from irreparable lesion coincidently with the empyæma (as in tubercular cases), in cases of complicated pyo-pneumothorax, and even in the simple chronic cases in adults in which the lung has been permanently bound down by inelastic adhesions. In all these cases the cure, if possible, must remain only partial, even after the most extensive operations. It is therefore important to establish, approximately, in advance and in each case, the limits of success that may be attained by therapeutic interference, and to weigh carefully the risks to be incurred on the one hand and the results that may be expected on the other before undertaking any definite procedure. When this sort of prognostic calculation leaves a balance unfavorable to the patient, it is preferable to abstain from inflicting unnecessary and even dangerous traumatisms of doubtful utility, and to limit our assistance to palliative treatment.

On the other hand, in the simple and recent cases we should be

prompt and energetic in our interference, for in these cases operative treatment is rewarded by the most happy and perfect results. Here, nevertheless, a certain conservatism is judicious. We should begin always by the less mutilating procedures, reserving the major operations for the more rebellious cases, in which all other considerations are subordinated to the final saving of the patient.

Passing now from the general to the concrete, let us consider the various procedures that the advanced technique of modern surgery places at our command to meet the aforesaid three indications.

These measures resolve themselves into—1, simple thoracentesis with aspiration; 2, aspiration with antiseptic irrigation; 3, continuous or permanent drainage into a vacuum, or syphon drainage; 4, perrigation by through-and-through drainage; 5, radical operation (antiseptic pleurotomy), with or without costal resection; 6, multiple rib-resection; 7, osteothoracoplasty, with or without pleurectomy (Schede).

1. *Simple Thoracentesis with Aspiration*, as practised for the removal of non-pleuritic effusions (*vide* Thoracentesis), is a procedure that is applicable only to those cases of empyæma which are exclusively due to pneumococci; in other words, to the empyæmas of children. In these cases the purulent collection has a natural tendency to recovery, either by spontaneous absorption or by evacuation. Even in these cases, however, aspiration frequently fails, and resort must be had to the more radical operation. Still, the frequency with which aspiration is followed by recovery in the infantile cases justifies its continued use in pædiatric practice. It should be remembered, however, that if the first aspiration is followed by reaccumulation we should immediately resort to antiseptic pleurotomy, and not follow the teaching of the older authors, who insisted upon repeated tappings. Antiseptic pleurotomy in the pneumococcal empyæma of children is not only an easy operation, but one almost invariably followed by success. In fact, the inherent tendency to recovery in the purulent pleurisies of children, owing to the flexibility of young ribs, is so great that evacuation, by no matter what means, is almost always followed by recovery.

2. *Simple Aspiration, followed by the Injection of Antiseptic Solutions*, has given some good results, but exceptionally only, and always in cases in which the natural tendency to recovery is great, as in children. Parker, and more lately Baelz, Kushimura, Fernet, and others, have reported favorable results with various solutions, such as those of quinine, salicylic, boric, and carbolic acid, weak sublimate solution, chloral, chloride of zinc, naphthol and creolin, etc. None of these agents should be allowed to remain in the pleural cavity, for fear of toxic phenomena. We do not linger over this practice, for it is not only dangerous, but almost invariably disappointing when compared to the

other methods to be described. It is a method that has more of historical than practical interest.

3. *Constant Drainage by Syphon Action, with or without Antiseptic Irrigation*, has as its main object the securing of constant drainage of the purulent products without incurring the risk of air-contamination. At one time this mode of treatment was quite popular in France, when, owing to the introduction of Potain's syphon, the method was easily carried out. Lately there has been a revival of this practice in Germany, where, under the name of Bülau's method, it has found extensive application. While, *a priori*, syphon drainage would appear to be an ideal practice, experience teaches that it is often most disappointing and fallacious. Immermann of Bâle, who is one of the most distinguished advocates of this practice, admitted at the Ninth German Congress for Internal Medicine (April 15, 1890) that "this method gives good results only in recent empyæmas in which the pus is not too thick, notably in double empyæmas, in which we should avoid the formation of a bilateral thoracic fistula. In the metapneumonic pleurisies, in which the pus is very thick (and loaded with flocculi) and there are many adhesions, evacuation of the pleural contents by this method is frequently not only quite difficult, but impossible. As to the empyæmas in which there is a large excess of pus, the danger of septic absorption is too great to permit of slow evacuation, and the radical operation (pleurotomy) must be performed.

We may say, therefore, in a general way, that the syphon method may be adopted only in recent cases in which the expansile power of the lungs is not lost, and in which a preliminary aspiration reveals the presence of a thin, liquid, inodorous pus, free from large flocculi or fibrinous masses; it should be reserved exclusively for adults or older children who can receive the constant attention of an intelligent nurse.

Of the various apparatuses that have been designed upon the syphon principle, the Potain and Bülau contrivances are the best known, and deserve special mention:

"Potain's ingenious instrument, based upon the syphon principle, enables us alternately to empty the pleural cavity into a basin of water and, by reversing the instrument, to inject the sterilized or antiseptic solution (sterilized salt water preferably, 1 drachm to the pint) into the pleural cavity, thus washing out, as often as necessary and with ease, the purulent collection and cleansing the cavity.[1] Potain's syphon is composed of an india-rubber tube 30 centimetres in length, to be introduced and remain in the pleural cavity. This tube is introduced through the canula, after the withdrawal of the trocar, to the depth of at least 20 centimetres, in order that its extremity should reach the posterior wall.

[1] We shall subsequently refer extensively to the contraindications of irrigation in the pleura when dealing with Pleurotomy.

the tube having been previously filled with antiseptic solution. The outer extremity is put into a basin containing water. The part of the tube at the outside of the orifice is closed by a *serrefine*, or clamp, just beyond the shield, as is also the extremity in the water. Another tube is connected with the chest portion. This can be used for introducing warm *sterilized* salt water (1 drachm to the pint) preferably, or other mild antiseptic solutions, to wash the pleura. The syphon of Potain has very decided advantages over the metallic or hard-rubber drainage-tubes. It prevents the introduction of air, and enables us completely to empty the cavity (in the proper cases) as frequently as is necessary, without pain, without change of position or fatigue to the patient; and this prevents attacks of coughing. All this is done slowly, and the flow can be arrested at any moment by means of the clamps. When repeated washings are required the patient himself can perform them with ease."[1]

The so-called Bülau method is based on the same principle that guided the construction of the syphons and subaqueous drains of Playfair, Pugge, Goodhart, and F. H. Williams of Boston, and is practised as follows: "A thick trocar is thrust in between the ribs, and the moment it is opened a disinfected draining-tube, which exactly fits in the canula, is passed into the pleural cavity as far as possible, and closed by a clamp. The canula is then carefully extracted, and a second clamp applied to the tube between it and the thorax, when the first clamp is removed and the canula slipped off. The rubber tube, which should be a metre and a half long, is now attached to a glass tube which passes through a rubber cork almost to the bottom of a bottle partly filled with some antiseptic solution. The bottle should also have a mouth-piece, through which any necessary suction may be made should the draining-tube become clogged up in any part of its course. The patients are soon able to go about carrying their bottle with them."[2]

In order to hold the drainage-tubing in the chest and prevent it from slipping, a perfect antiseptic dressing consisting of iodoform gauze and bichloride absorbent cotton should be carefully packed around the tube, which should be held in position by being drawn, as L. Powell of Toronto has suggested,[3] through a small hole punched in a piece of strong rubber bandage, which is fastened around the chest over the dressing.

At the Ninth Congress of German Physicians (April, 1890), already referred to, Immermann reported that in a collection of 57 cases treated

[1] F. Donaldson, Pepper's *System of Medicine*.

[2] Immermann, *Annual of the Universal Med. Sciences*, vol. iii. 1888.

[3] *Vide Ibid.*

by Bülau's method in Hamburg, Gratz, and Basle, 49 cases, or 86 per cent., were directly cured by it.[1]

The methods thus far described, while attempting the complete evacuation of the pleural contents, aim also at the exclusion of the atmosphere, and for this reason must be classed together under the designation of the *closed methods.*

4. *Perrigation by Through-and-through Drainage.* The attempts at open drainage, as originally practised by Chassaignac, Kidd, Banks, and lately Michael, aim at the continuous evacuation of the pus by means of single or double openings in the chest at different or opposite points, selected with the view of securing the advantage of gravity, etc. This method—which is also known as *perrigation*, when the tubes are situated at opposite points, so as to allow injections of antiseptic fluids to irrigate the whole pleural space—has become almost obsolete in the practice of the day. The principles of antiseptic and aseptic surgery have been better understood, and experience has amply confirmed the fact that under the ægis of listerism the old Hippocratic operation of pleurotomy by free incision into the pleura was, after all, the only certain and secure way of evacuating the pleural cavity of all pus and necrotic débris.

5. *Antiseptic Pleurotomy* is, in fact, the most rational way of dealing with all kinds of purulent accumulations in the pleura. By giving a ready large exit to all purulent accumulations not only does it secure a thorough evacuation of the pleura, but it ensures their constant outflow as well, thus most effectually preventing their accumulation. While the danger of septic infection very justly deterred the older operators from resorting to it as the initial operation in empyæma, the remarkably favorable statistics that have accumulated since the introduction of listerism have demonstrated that by the addition of antisepsis and asepsis this once formidable operation has now become the safest and speediest way to restore the health of an empyæmatous patient. With Senn[2] we believe that it is a good plan in every case to combine aspiration with exploration, for purposes of improving the conditions for a radical operation. By aspiration we demonstrate the presence and kind of pus in the pleural cavity, and by removing the fluid completely or in part we aid the expansion of the lung, which, by the time the radical operation is performed, will probably have become adherent lower down. Aspiration is to be followed in the course of two or three days by a radical operation. The operation for empyæma must always be done with the strictest antiseptic precautions, as any mistake or negligence in this regard is exceedingly

[1] *Vide* also "A Plea for Syphon Drainage," by G. Bülau, *Zeitschrift für klinische Medizin*, Dec., 1890.

[2] *Principles of Surgery*, 1890, p. 283.

liable to be followed by infection with putrefactive bacteria—an occurrence which would greatly increase the danger from sepsis.

We have already given some hints as to the anti-septic details to be adopted in the performance of simple thoracentesis; it is now still more important to follow these details here. The preparation of the patient's skin and the sterilization of the instruments and dressings require special attention. We have been in the habit of sterilizing our material with the aid of an Arnold steam sterilizer, and subjecting both instruments and dressings to a moist temperature of 212° F. for over half an hour. Only newly-sterilized sponges that have not been previously used or mops of sterilized gauze are used for wiping the surface. The skin is best prepared by thoroughly washing the affected side with warm water and German green soap, then ether or alcohol are used to remove the fatty matter, and finally a hot sterilized towel, dipped in 1 : 1000 sublimate, is laid over the seat of operation. The hands and nails of the operator should be scrupulously cleaned and brushed by Fürbinger's method or in the manner recommended for the patient's surface. The instruments—bistouries and scalpels, dissecting and artery forceps, retractors, periostome, sequestrum forceps, bone-gouge forceps, Liston's bone nippers, drainage-tubes, etc.—should be dipped in a porcelain pan containing 5 per cent. carbolic-acid solution.

The question of anæsthesia now follows. In children it is almost impossible to operate without a general anæsthetic. In adults a general anæsthetic (chloroform or ether) is always indicated unless the condition of the patient is such as to contraindicate its administration. Whenever the patient is much exhausted it is preferable to resort solely to local anæsthesia by injecting a 4 per cent. or 5 per cent. solution (aqueous) of hydrochlorate of cocaine subcutaneously along the proposed line of incision.

Shall the incision be made simply between the ribs, or shall the pleurotomy be preceded by a partial costectomy?

In children simple incision without resection is, as a rule, sufficient. In adults the removal of a piece of rib must be recommended in all chronic cases (*a*) in which the lung is bound down by adhesion and cannot be expected to expand readily; (*b*) in which thoracic deformity has caused an excessive approximation of the ribs, with a narrowing of the interspace; (*c*) in cases in which the preliminary aspiration reveals putrid or offensive pus.

The positive excision of a rib has for its object the securing of a large orifice that will not contract too readily, especially when the sinking of the chest wall takes place after the drainage of the accumulation. As in the metapneumonic empyæmas healing takes place promptly as a rule, it is preferable in such cases not to resort to this practice. In

almost all the other varieties of pleurisy, owing to the fact that they are usually due to the more resisting pyogenic cocci, it is best to resect the rib. In the primary tubercular variety, or that due to the opening of tubercular cavity in the pleura, it is best to abstain from intervention if the patient is weak, or to operate by the still more radical procedure to be described later if the favorable condition of the patient justifies it.

The site of the incision is a question of importance. In empyæma, even more than in simple pleurisy, the point of election has been the subject of great controversy.

In cases in which the pus has already perforated the thoracic wall and presents itself as a subcutaneous abscess (*empyema necessitatis*), it is simply necessary to open the collection at the most prominent or bulging point by a horizontal incision parallel to the ribs. In the absence of this indication the rule laid down by Godlee is the safest. As the retraction of the diaphragm is more rapid than the retraction of the lung, the opening in the thorax should be, as he teaches, as high as the centre of the effusion. This usually corresponds to the centre of the sixth rib on the right side, and over the seventh on the left, at a point halfway between the nipple and the axillary line. The incision must be about four inches in length, and extend down to the bone. Walther has recently, as the result of a series of anatomical studies, recommended the tenth rib posteriorly about a hand's breadth from the spine. While this may be the most favorable point for drainage, it is not to be recommended, because of the rise of the diaphragm subsequent to the operation, which must ascend beyond the level of the aperture and occlude the opening.

We should furthermore remember, as Guerin first taught, that the pleural cavity does not empty itself like a barrel, following the laws of gravity, but, obeying the expansive force of the lung and the crowding of the diaphragm, it causes the liquid to escape in the direction of the least resistance, and therefore toward any opening wherever situated.

After reaching the rib, the soft parts together with the periosteum are reflected from the bone with an elevator; the rib is then denuded of its periosteum posteriorly. If a piece of aseptic gauze is thrust between the bone and the soft parts, the detachment of the latter can be effected with the least difficulty and traumatism by using the gauze as a retractor. About one and a half inches of rib are now removed with two cuts of the bone-nippers or Denison's rib-cutter, which is an excellent instrument for the purpose.[1]

After the removal of the bone all hæmorrhage is checked. "If

[1] Trephining a disk of bone of a rib (Langenbeck, Stone) is a method still frequently resorted to, but is far less satisfactory than the resection of the rib.

the pleura feel tense and bulge into the wound, there is no necessity of making an exploratory puncture. If this is not the case, as a matter of precaution another puncture can be made at this stage of the operation to satisfy the surgeon of the presence of pus underneath. The incision into the pleura is then made with a bistoury in the centre of the periosteal gutter through this membrane and the pleura into the cavity of the chest. This incision must be large enough to allow the insertion of a drainage-tube the size of the little finger. The deep incision of the soft parts can be readily dilated to the requisite extent by the insertion of the finger, which may also be used in interrupting the flow" (Senn).

If a simple pleurotomy is performed, the incision should be made in the very centre of the interspace, following a direction parallel with the ribs. In very thin chests the incision may be made with one plunge of the bistoury, and to be subsequently enlarged with the probe-pointed knife; but this is not safe usually, and the operation should be done preferably in two stages—one incision (about four inches) through the thickness of the skin and subcutaneous tissues, and the other involving the whole thickness of the muscular wall and pleura.

"A great deal of information is gained, as soon as the incision into the chest has been made, in reference to the expansibility of the lung. If this has not been much impaired, the pus will escape with much force, especially during inspiration. Rapid evacuation is attended with some danger from over-distension of the heart and vessels in the lung, and must be guarded against by interrupting the flow from time to time by inserting the index finger into the opening. If the lung expand promptly, its lower margin can often be seen through the opening toward the end of the evacuation. The more the lung expands, the less the amount of air rushing through the opening into the chest. In order to prevent syncope upon the sudden diminution of intrathoracic pressure during the evacuation of the pus, I have been in the habit of administering, before the anæsthetic is given, $\frac{1}{100}$ grain of atropine with $\frac{1}{8}$ grain of morphine, hypodermically, with an alcoholic stimulant by the mouth or rectum.

"If, as is often the case, the pleura is lined with thick, partially detached membranes, these should be removed with a dull curette, as they are invariably infected with pus-microbes, and their presence in the pleural cavity would prolong the infection and retard recovery" (Senn).

Washing out the pleura was formerly an invariable practice after pleurotomy, but a little knowledge of the etiological conditions, as well as the result of unfortunate experience, has taught that this practice has its strict limitations. In all cases in which there is a concomitant bronchial fistula irrigation is necessarily contraindicated. In all cases

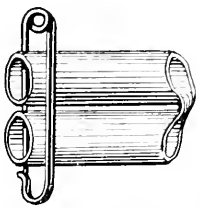
in which there is no fetor, showing the absence of saprogenic bacteria, it is likewise contraindicated, because it is superfluous if antiseptic precaution and aseptic dressings are used. Furthermore, since Raynaud in 1875 called attention to the accidents that may result from irritation of the pleura by irrigation, apart from the toxic and fatal phenomena that have frequently followed injection with the more powerful antiseptics (sublimate, carbolic acid, and iodoform), we have learned that the greatest circumspection is necessary in the practice. The recent statement by Bowditch[1] that he has only found it necessary to wash out the pleural cavity once in 399 operations upon 250 patients, and that he, who is so experienced an operator, regards it as a serious and dangerous procedure, is in itself quite suggestive. If we add to this the not rare occurrence of the dangerous phenomenon known as pleural epilepsy (Brouardel, Vallin, Boyer, Lepine, Desplats, Weil, DeCerneville), which sometimes terminates fatally, and may end in monoplegia or hemiplegia, we must agree that there is some justification for conservatism in the routine practice of irrigation. Nevertheless, in the putrid or fœtid types of empyæma, or even in those frequent cases in which the dull curette dislodges large pseudo-membranous masses, washing of the pleura becomes a necessity. Then the choice of the proper antiseptics becomes a matter of some consequence. In the more fœtid cases, with heavy, grumous, and fibrinous deposits, it is preferable to remove a little more rib than usual, in order to enlarge the opening and to wash with simple distilled or boiled and filtered water containing about 1 tea-spoonful of common salt to a pint, until the water returns clear. In most cases of this character wiping the pleura with mops of plain sterilized gauze is not superfluous after irrigation. When there is fœtor, the use of Thiersch's solution (2 parts salicylic acid and 12 parts of boric acid in 1000 of sterilized water), Labarraque's solution of chlorinated soda (1 part to 15 or 20 of water), a 10 to 50 per cent. solution of peroxide of hydrogen (Trommsdorf), a thymol solution (Ranke, 1 : 1000 or 1 : 500, added to Thiersch's solution), or the acetate of alumina (Burow), in 1 to 5 per cent. solution, may be freely used without danger of intoxication, care being taken that the solution be always employed warm, as death may follow from the shock of cold irrigation. In addition to this, the irrigation should always be made by using the steady stream of a syphon or fountain syringe, and never by the interrupted flow of a force-pump.

After the pleural contents have been evacuated drainage is in order. For this purpose a resisting, fenestrated, soft-rubber tube, the size of the little finger, should be used. In children one tube is often sufficient, especially if folded upon itself in the manner suggested by

[1] *Annual of the Universal Med. Sciences*, June 2, 1889.

Cabot[1] (Fig. 41). If the case is a recent one, and there are great expansion and mobility of the lung, it is only necessary for the tubes to be of sufficient length to project a short distance within the cavity; long tubes in these cases irritate unnecessarily. If, on the other hand, the lung is bound down by adhesions, and does not approach the opening, leaving a considerable cavity, then a set of long tubes which will reach the deepest pockets and recesses of the cavity may be used with advantage. The arrangement of the tubes in the manner suggested by Dujardin-Beaumetz (*en flute de Pan*) is probably the best, though the advantages of the grouping of the tubes may be obtained by more simple means, and the shield shown in the cut (Fig. 42) dispensed with.

FIG. 41.



Cabot's Folded Drainage-tube for Empyæma in Children.

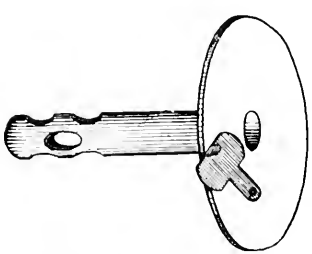
FIG. 42.

Arrangement of Drainage-tubes *en flute de Pan* (Dujardin-Beaumetz).

A safety pin may be conveniently substituted for the shield.

A simple long safety or beaded pin will do as well if it is made to transfix the required number of tubes; if a beaded pin is used, the pointed end should be protected with a rubber or small cork tip. By the use of these precautions the tube will be prevented from slipping into the cavity, and thus giving rise to an ugly accident.

FIG. 43.



C. Denison's Soft-Rubber Valvular Tube.

Useful in later stages of thoracic fistula after empyæma when there is diminished suppuration and it is necessary to help the compressed lung to expand.

Later on, as the suppuration is reduced to a minimum and the opening contracts, it may be advantageous to use (especially in chronic cases with atelectasie and bound-down lungs) the valvular drainage-tube recently recommended by Denison of Denver (see Fig. 43).[2] In this instrument the tube, which is made of soft rubber, is closed externally by a movable, very delicate, thin platinum valve, which can be

[1] Keating's *Cyclopædia of Diseases of Children*, 1889. [2] *Sanitarian*, Nov., 1890.

swung to one side for the purpose of injecting the cavity or cleaning the tube. "This valve is intended thoroughly to close the opening against the entrance of air, yet be so flexible that the increased intrathoracic pressure due to cough or forcible respiration will force out the contained air or fluid. The result is, that the air is all the time being pumped into the atelectatic lung through the exaggerated mechanism of breathing. It is intended that the patient of his own motion can, by straining to increase intrathoracic pressure, force the air or pus out of the tube, but by no effort of his own breathing can he draw air back through the tube into the pleural cavity. In this way the first expansion of the lung may be hastened and the cavity obliterated. But a good aseptic occlusive dressing, such as the one here recommended, when well applied will answer with ordinary drainage-tubes all the purposes of this tube."

In dressing the wound the following method is usually adopted by the author: First, about half a yard of iodoform gauze (10 per cent.) is loosely packed around and over the tubes. Over this about one inch thickness of bichloride gauze (1 : 2000, Laplace's formula) or the plain sterilized gauze is made to cover the iodoform layer for a large area over the wound, and over this, again, a heavy pad of bichloride or carbolated cotton (three or four inches thick) is applied to provide for equal pressure. Finally, the whole dressing is held together by a breast-bandage, supported by an elastic, loosely-woven bandage (manufactured by Messrs. Johnson & Johnson and Seabury & Johnson) which is excellently adapted for this class of operations.

A dressing thus applied need not be renewed for twenty-four hours in ordinary recent cases. We cannot too much insist upon the absolute necessity of the greatest caution in renewing the dressings. Unfortunately, too many nurses, students, and physicians are under the impression that the first dressing is the only one that requires scrupulous care as to the aseptic precautions; they imagine that because there is pus in the dressings the antisepsis is a failure, and that further precautions are unnecessary. No more serious blunder could be entertained, and its commission means a fundamental misconception of the principles of asepsis. In the case of an ordinary empyæma our external dressing and careful antiseptic precautions cannot immediately affect the pyogenic and pathogenic micro-organisms that are contained in the purulent pouch, but they do prevent the introduction of saprogenic or septic organisms which will transform a simple *pus* cavity into a *septic* cavity. For this reason it is impossible to urge too emphatically the necessity for the utmost vigilance on the part of the dresser of the wound, for any neglect on his part to be aseptically clean may most seriously compromise the life of the patient. This vigilance should not relax until the closure of the wound in acute cases, nor in

the chronic cases until the secretion of pus is so scant that there can be little, if any, danger from decomposition. Should the pus be originally septic or become so at any time, as manifested both by the temperature and fœtor, then aseptic occlusion must give way to frequent antiseptic irrigations, as previously described. In these cases the first aim of antiseptic surgery—*i. e.* aseptic union by primary adhesion of the opposed pleural surfaces—can no longer be entertained, as healing can only take place by granulation and protracted suppuration. In these cases also irrigation of the pleura with hot Thiersch's solution by means of a syphon, on the principle of the Potain apparatus, may be required for hours at a time. Usually, however, the radical operation, when performed with scrupulous regard to asepsis, is very satisfactory in all cases in which the pleura is opened before permanent adhesion and crippling of the lung has taken place.

In the most favorable conditions complete recovery, including the closure of the thoracic wound, has been observed in ten to twenty days (Schede); Hack obtained an average cure in twenty-three days; Moutard-Martin, in twenty-three to twenty-eight days; but the nearest approach to general results are given by Peyrot and Robert, who estimate that the average duration of the treatment is four months in adults and two months in children (Widal).[1] Nevertheless, there are many cases, unfortunately too many, in which, owing to the protracted postponement of operative interference, the lung has remained permanently bound down by adhesions, and the resisting chest-wall has not been able to sink in sufficiently to permit the pleural surfaces to come in apposition; in these cases the external wound is liable to remain open, and a thoracic fistula, communicating with the pleura, constantly discharging pus, will remain.

The only hope of remedying this unfortunate condition lies in 6 the *multiple resection of the ribs* of the affected side, to prevent the chest-

[1] Professor Küster of Berlin, whose wise motto is never to allow an empyæma to grow old, performs pleurotomy in a different way from that described in the text. His method consists in making an incision into the fourth interspace anteriorly through which is passed a long probe (a long uterine probe will do), by which he explores the interior of the empyæmatous cavity, and by this means determines the precise location of the most dependent portion behind, where he resects one or more ribs freely enough to permit him to obtain an easy view of the interior of the cavity. He then irrigates with salicylic solution and mops over the interior with a sponge. He has operated on 109 cases, the largest statistics thus far presented. His cases include some old cases of bronchial and thoracic fistula. His results are as follows: complete cure in 60, or 52.04 per cent., not cured, 17, or 15.59 per cent., died, 33, or 29.35 per cent. of the total cases. Only 6 deaths were directly due to the operation. Küster furthermore maintains that every case of empyæma is an indication for operation, even when occurring in markedly tuberculous patients. While we believe that Küster's operation is an excellent one for the chronic cases, still, with Schede and others, we also believe that the anterior puncture is superfluous in the acute or recent cases. (*Trans. Tenth Int. Med. Congress*, 1890; *Rev. de Chirurgie*, 1890.)

wall from sinking in and obliterating the pus-forming cavity. This operation, which was first practised by Symonds in 1869, Letievant in 1875, but systematized and popularized by Estländer of Helsingfors, by whose name it is now universally known, has its strict limitations. The operation of Estländer may be considered as absolutely contraindicated—1st, in advanced age; 2d, in cases of pleurisy associated with marked tubercular or other lung lesions; 3d, in albuminuric or other cachectic subjects; 4th, in very large cavities, with completely and permanently collapsed atrophied lung; 5th, in comparatively small cavities if these are limited to the extreme upper segments of the thorax. On the other hand, as Berger's statistics show, the longer the fistula remains open after pleurotomy, the less easy is it to cure; for this reason, and provided there are no other contraindications, the advantages should be seriously considered early. If the fistula shows no sign of healing three or four months after operation, and the retraction of the chest appears to be arrested, it is best not to delay operative interference.

The operation is usually performed by making several transverse (horizontal) incisions in the interspaces parallel with the ribs, as originally recommended by Estländer, or by making an H-shaped incision (Trelat) or an inverted ⊥ (Nicaise). These incisions are made in the lateral aspect of the thorax, preferably the subaxillary region. By dissecting and retracting the skin-flaps that result from these incisions the ribs are readily exposed, and sections of each, varying from three to six centimeters, are removed. The resection of the ribs is effected separately and subperiosteally, though Olliver has taught that in children the growth of bone from the periosteum is so rapid that it is best to remove the periosteum as well as the bone.

The number of ribs to be removed and the size of each section must depend upon many circumstances, especially the size of the cavity. As a rule, the first and tenth ribs, which support the sternum, should be respected. After the excision of the ribs and completion of the hæmostasis the cutaneous flaps are brought together by suture, due provision being made for drainage.

In the original Estländer's operation the pleural cavity itself is not opened, the costal resection being effected subperiosteally. In many cases, however, it is preferable to lay the cavity freely open as well, and subject it to a systematic curetting in order to remove degenerate foci, and to pack it with sterilized or weak iodoform gauze; in other words, to subject the chronically diseased pleura to the same principles of treatment that are applied to other suppurating cavities.

Not only is curetting done, but the excision of the thickened parietal pleura as well, is now being practised with success. Schede of

Hamburg, who believes that Estländer's operation is totally incapable of securing the necessary collapse of the chest-wall in adults, resorts to a complete *thoracoplasty*, by which all the soft parts, with the pleura and ribs, are removed from the side of the chest, leaving only a skin-flap to cover over the enormous visceral wound.

At the Tenth International Congress at Berlin (1890) Schede reported 11 cases in which he had resorted to this truly heroic operation, of which he lost only 3—1 dying of iodoform-poisoning, another by collapse, and a third of exhausting suppuration. Other surgeons—Bouilly, Thiriar, Boeckel, Rugi—while not dealing with the subject on so large a scale, have also had excellent results from this free and open treatment of the pleura.

One word, finally, before dismissing the surgical treatment of empyæma, and that is in reference to interference in the tubercular cases.

While many writers teach, with Senator and others, that the existence of tubercle contraindicates the radical operation, we believe that the whole question depends upon the degree of tuberculosis and cachexia affecting the patients.

To operate should be the rule in all cases associated with slight tubercular lung-lesions and a good general condition. In many cases the pulmonary lesions appear to be arrested by the removal of the pleural exudation.[1]

On the other hand, it is imperative to abstain in the advanced cases in which one or both lungs are seriously involved and the patient is succumbing to hectic. To operate under these circumstances, except by simple palliative aspiration, would of course merely promote euthanasia.

Medical Treatment.—Finally, it is hardly necessary to insist upon the medicinal, dietetic, and general hygienic support that patients who have been operated on for empyæma should receive. In few morbid conditions is there so marked general physical deterioration, owing to the hectic and protracted suppuration. The drain on the corpuscular elements of the blood is enormous, as is soon revealed by the waxy pallor and progressive emaciation of even the acute cases. Throughout the whole surgical treatment the patient should be carefully supported by the frequent administration of stimulants—whiskey, brandy, or rum—in the shape of toddy and milk-punch. A plain but very substantial diet should be insisted on. Free ventilation and plenty of sunshine are great aids to recovery. The cough which accompanies these cases is frequently very harassing, and demands medicinal assistance. The preparations of opium are the only drugs which afford relief. They should, however, be administered with caution, and only

[1] *Vide* cases reported by Bricheteau, Aran, Hayem, Widal.

when the cough or other indication necessitates their use. The following formulæ will be found useful:

℞. Morphinæ sulphatis, gr. ij;
Aquæ lauro-cerasi, f℥ss;
Syrup. tolutani, q. s. ad f℥ij.—M.
Sig. A tea-spoonful when needed.

Also, if there is considerable circulatory depression, shown by weak pulse and cold extremities, with irritating cough:

℞. Syrup. morphinæ (gr. j–℥j), f℥j;
Spiritus ammon. arom.,
Spiritus ætheris comp.,
Tinct. digitalis, *āā.* f℥ij;
Syrup tolutani, f℥j;
Aquæ menthæ piperit., ad f℥vj.—M.
Sig. One table-spoonful every two or three hours.

In cases in which the stomach is very irritable hypodermic injections of $\frac{1}{8}$ or $\frac{1}{4}$ grain of sulphate of morphine should be given, or the following may be used:

℞. Cocainæ hydrochlor., gr. ss;
Sodii bicarb., ʒss;
Aquæ lauro-ceras., f℥ij;
Syrup. morphinæ (gr. j–℥j), f℥ss;
Aquæ menth. piperit., q. s. ad f℥iv.—M.
Sig. One table-spoonful every hour.

This will generally control not only the cough, but the accompanying dyspnœa and vomiting.

In the septic cases with hectic sweats the addition or separate injection of $\frac{1}{150}$ grain of atropine is of advantage. For the fever of these septic cases sulphate of quinine is indicated in large and frequent doses. The antipyretics are contraindicated in these cases, and should not be used when the febrile movement is not alarming in itself. Quinine, in fact, should be administered for its tonic effect throughout the whole of the treatment, from the moment pus is recognized in the pleura to the end of convalescence. Instead of the antipyretics, frequent cold sponging with water, bay rum, or the *eau sédative* (Raspail) of the French Codex is most soothing and beneficial. In the diarrhœa that so frequently accompanies the septic cases either the pilula plumbi cum opii or the following mixture will be found useful:

℞. Bismuthi salicylatis,
Bismuthi subnitratis, āā. ʒij;
Vini opii, f℥j to ʒij;
Aquæ lauro-ceras., f℥j;
Tinct. catechu. comp.,
Tinct. kino, āā. f℥iij;
Olei sassafras, ♏xvj;
Mucilag. acaciæ,
Syr. menth. piperit., āā. q. s. ad f℥vj.—M.

Sig. One table-spoonful every two or three hours, according to the amount of diarrhœa.

If the discharges are fœtid, the addition of 10 grains of salol every two hours in tablets or capsules will act as a corrective.

When convalescence is established, quinine, combined with strychnine, iron, and arsenic, is the best hæmatic tonic. In the tubercular cases the addition of the hypophosphites is especially serviceable.

Thus in non-tubercular cases:

℞. Strychninæ sulphatis, gr. j;
Liquor. potassii arsenitis, f℥ij;
Ferri et quininæ citrat., ʒiv;
Glycerini,
Aquæ cinnamomi, āā. ad f℥viij.—M.

Sig. One tea-spoonful after meals, followed by half an ounce of whiskey diluted in toddy.

When the palate is too sensitive, the same remedy may be given in pill form:

℞. Strychninæ sulphatis, gr. j;
Sodii arsenitis, gr. j;
Quininæ sulphatis, ʒj;
Mass. ferri carbonat., ʒj.—M.

Ft. in capsul. No. xxx.

Sig. One capsule three times daily after meals.

In the tubercular cases:

℞. Liq. potassii arsenitis, f℥j;
Syrup. ferri iodidi, f℥iij;
Elixir. calisayæ (National Formulary), f℥viij.—M.

Sig. One table-spoonful three times daily.

The compound syrup of the hypophosphite of soda, lime, strychnine, manganese, etc., and especially cod-liver oil with guaiacol (cod-

liver oil, 1 pint; guaiacol, 2 drachms), and inhalations of oxygen, are very helpful.

Furthermore, the patient should be urged, as soon as his strength will permit, to walk out-doors, to exercise his lungs by systematic pulmonary calisthenics and by mountain-climbing or other suitable exercise, as indicated in the section on the After-Treatment of Non-purulent Pleurisy.

PYOTHORAX.

While the word "pyothorax" is frequently used synonymously with empyæma, there is nevertheless a difference in the application of the two words. By pyothorax is meant an accumulation of pus in the pleura of non-pleuritic origin. The word simply involves an etiological distinction; in the light of the therapeutic indications the two conditions are practically identical.

HYDROTHORAX.

By this term is meant a secondary non-inflammatory dropsy of the pleura, usually involving both sacs. It is most frequently dependent upon conditions involving marked intravenous tension, combined with hydræmic states of the blood; for this reason it is most frequent in the latter stages of valvular heart disease and in chronic nephritic inflammations. The treatment is entirely subordinate to that of the general condition which gives rise to the dropsy. As there are no plastic exudations or neo-membranous formations to interfere with the absorbent functions of the pleura, marked beneficial effects may always be expected from the exhibition of those agents which will diminish intravenous tension and will tend to fill the arterial tree (digitalis, strophanthus, convallaria, caffeine citrate, strychnine); derivative medication will also produce much more marked results than in the case of the exudations due to pleurisy. Epsom salt in concentrated solution (Matthew Hay's method); elaterium ($\frac{1}{4}$ to $\frac{1}{2}$ grain), modified by hyoscyamus; compound jalap powder, gamboge, and scammony, are valuable intestinal derivatives. Of the diuretic class, for all cases, diuretin is prominent, and when the cause of the dropsy resides in the heart the free exhibition of sugar of milk (1 to 2 ounces daily), combined with the cardiac tonics, as recommended by Germain Sée, is likely to give rise to surprising results. Of the diaphoretics, the pilocarpine, administered hypodermically, is still *facile princeps*.

When the fluid accumulates very rapidly, and the signs and symptoms of pulmonary compression become threatening, aspiration, practised in accordance with the rules laid down in the section on thoracentesis, will be the most certain means of affording relief. The limpidity of the fluid and the absence of floating exudative coagula will permit of the removal of the fluid with the smallest needle or trocar of the aspirator, thus ensuring the least pain and freedom from the petty annoyances incident to the obstruction of the canula.

HÆMOTHORAX.

An accumulation of blood, of non-inflammatory origin, in either one or both pleural cavities, is called hæmothorax. The hæmorrhage may be due to traumatic or pathological causes. Stab, punctured, and gunshot wounds are the most frequent causes of the traumatic variety. In these cases the hæmorrhage is frequently complicated with pneumothorax. The hæmorrhage proceeds either from a visceral or parietal vessel; in the latter case the internal mammary and intercostals are most frequently implicated. In the visceral wounds the danger of hæmorrhage increases from the periphery to the root of the lung, wounds of the pulmonary trunks, azygos, and vena cava causing almost immediate death from vascular depletion, syncope, and shock. Of the pathological causes, aneurism of the aorta or its thoracic branches, ulcerations of the internal mammary and intercostal arteries from carious ribs (peripleuritic abscesses), from varicose veins of the pleural surface (Caldani), or from the rupture of a bleeding tuberculous vomica into the pleura (Fräntzel), are the most prominent causes.

It is manifest that the therapeutic indications will be profoundly influenced by the cause of the hæmothorax. There are, nevertheless, a few general and fundamental principles which dominate the therapeutic indications, and which exercise a practical influence on our mode of treatment.

In all pleural hæmorrhages an attempt should be made to differentiate the cases in which infection is, *ex necessitate*, an accompaniment of the hæmorrhage from those in which it is not. In gunshot and punctured wounds, for instance, if the external wound is sealed promptly, infection is not probable, since the wound is usually, primarily, aseptic; and if the hæmorrhage is not progressive the patient will suffer only from the shock, the anæmia, and the mechanical displacement produced by the hæmorrhage, but not from a secondary puru-

lent or septic pleuritis due to infection. It is also a fortunate circumstance that many of the pathological conditions which cause hæmorrhage are not always pyogenic *ab initio*, though infection is here more common than in the traumatic cases.

Again, as shown by the experiments of Bouley, Trousseau, and LeBlanc, the blood extravasated into the pleura is capable of rapid spontaneous absorption, provided it be not contaminated with pyogenic or saprogenic micro-organisms. In this respect the pleura shows a characteristic common to all serous membranes. The pleura, however, displays this capacity for blood-absorption in a degree inferior to the peritoneum, which so greedily absorbs blood that in acute traumatic anæmia its absorbent powers have led to the practice of "intraperitoneal transfusion" (Ponfick and others). This capacity for unaided absorption on the part of serous membranes should be remembered in connection with hæmothorax, and should moderate the over-anxiety of the practitioner who, without due consideration of the resources of Nature, would attempt to remove the effused blood simply for the fear of its presence.

Apart from these general considerations, the therapeutics of hæmothorax are largely governed by the same principles which underlie the treatment of hæmorrhage elsewhere. The means at our command may therefore be divided into medical and surgical.

Medical.—Rest is, above all, indicated, and is best secured by the horizontal decubitus and exhibition of opium or morphine in quantities sufficient to obtund pain and diminish the frequency of the respiratory movements. It is preferably administered in the shape of morphine sulphate ($\frac{1}{4}$–$\frac{1}{2}$ grain) hypodermically. Cold to the chest by means of the ice-bag, aided by the internal administration of fluid extract of ergot ($\frac{1}{2}$ to 1 drachm) every hour while hæmorrhage is progressing; ergotine (Bonjean's, Merck's, Parke Davis & Co.'s) hypodermically (1 to 5 grains); hydrastine muriate or sulphate by the mouth ($\frac{1}{2}$–1 grain); hydrastinine (Parke Davis & Co.'s); fluid extract of hamamelis (1 to 2 drachms); acetate of lead in pill (5 grains); capsules or pearls of spirits of turpentine, muriated tincture of iron, sulphuric-acid lemonade, etc., are especially indicated in the treatment of visceral or parenchymatous bleeding.

Surgical.—When the hæmorrhage is of traumatic origin and due to the lesion of a parietal vessel, an attempt should be made to secure the bleeding point, especially if the internal mammary or the intercostal vessels be involved. In some cases in which life is nearly extinguished in consequence of vascular depletion time may be gained by sustaining the circulation with saline solution (1 drachm of common salt to 1 pint of water) injected intravenously until the pulse is restored to normal fulness. By this means the patient may be restored

sufficiently to permit the hæmorrhage to be permanently arrested by either ligating or obturating the bleeding point. Whether the bleeding point be discovered or not, it is best to occlude the wound immediately by antiseptic dressings, such as iodoform gauze, collodion, cotton, etc., and to await the development of further indications. If the increasing dyspnœa, intercostal bulging, and physical signs point to a progressive hæmorrhage with compression of the lung, which is rapidly increasing in spite of morphine and the ice-bag, then intercostal pleurotomy under strict antiseptic precautions is the only means of securing relief. Cautious aspirations may be tried, but, owing to the rapid formation of clots, it is often impossible to relieve the compressed lung by this method; nevertheless, a preliminary attempt at partial evacuation by this means is justifiable, and is worthy of trial, though it is more than probable that the rapid reaccumulation of blood will necessitate the subsequent free incision of the pleura. Larrey, who was probably the first to practise this operation in traumatic cases, always advised that only the least quantity of blood required to secure relief should be removed by the thoracic incision, in order not to disturb the primary hæmostatic thrombus. By rigorous adherence to antiseptic methods it is possible to perform pleurotomy in these cases with great prospect of preventing the final decomposition of the remaining clots. If suppuration should supervene, we should be guided in the treatment by the rules that have been laid down in dealing with empyæma.

PNEUMOTHORAX.

Hydro- and Pyo-pneumothorax.

The collection of any kind of gas in the pleural sac is called pneumothorax; if serum or other watery fluid is added to the gas, the condition is designated hydro-pneumothorax; if blood, hæmo-pneumothorax; if pus, pyo-pneumothorax; if both blood and pus, pneumo-pyo-hæmothorax, etc.

The essential primary pneumothorax of the older authors, which was supposed to be due to the spontaneous development of gases in the pleura (Itard, Laennec), is no longer admitted; even the existence of secondary pneumothorax resulting from the decomposition of putrid purulent secretions (Jaccoud, Biermer, Wunderlich, Rosenthal, etc.) is only an exceptional, and even doubtful, occurrence. Our present knowledge of the pathology of pneumothorax reduces its etiology to either traumatic or non-traumatic causes, which, residing in the lung, pleura, or adjoining organs, lead to a perforation in the parietal or vis-

ceral layers, and thus to the admission of external air into the pleural space. The perforations due to stab and gunshot wounds and to lacerations by fractured ribs, contusion, and other results of external violence appertain to the domain of surgery. There is another form of traumatism, however, which especially interests the physician. We refer to those cases of simple pneumothorax which develop as a result of the laceration of the pulmonary parenchyma from violent inspiratory efforts or other conditions which suddenly increase the intrapulmonary tension. This condition has been undoubtedly observed in persons with apparently healthy lungs, and is a consequence of violent and sustained inspiratory efforts accompanying muscular strain, as in lifting heavy weights, in the expulsive efforts of parturition, etc. In the vast majority of the cases, however, an antecedent pathological condition in the lung which favors its laceration under increased pressure precedes the tear that leads to pneumothorax. In the cases in which the rupture takes place in a healthy lung the entrance of air is never followed by any other than the immediate consequences of the mechanical displacement produced by the sudden or gradual distension of the pleura. In the pathological cases, in which the admission of air is concomitant with the entrance of irritants or septic matter, the pneumothorax is promptly followed by the superadded symptoms of pleuritic inflammation, which ends in either serous, purulent, putrid, or gangrenous accumulations, according to the greater or less degree of virulence of the matter inoculated at the time of the rupture in the lung. Practically speaking, in the immense majority (90 per cent.) of the non-traumatic cases, as shown by the accumulated statistics of Saussier, Biach, Weil, Hughes, and West, the cause of pneumothorax is tubercular degeneration of the lung.

Of the other causes, empyæma (rupturing into a bronchus), gangrene of the lungs, bronchiectasis, pulmonary abscess, hæmorrhagic infarcts, pulmonary hydatids, abscess of the liver, emphysema, asthma, capillary bronchitis, and pertussis occupy a secondary but easily explained relationship with the causation.

Usually, pneumothorax is unilateral, though both pleuræ may be rarely involved. Owing to the greater frequency of tuberculosis in the left lung, left pneumothorax is the more common. It may also be complete or partial, according to whether the air enters the whole pleural space or only a small encysted locus.

At any rate, no matter what the particular cause of the perforation may be, we may conveniently group all the conditions into three types of pneumothorax (Weil)—viz.: (1) the open, (2) closed, and (3) the valvular pneumothorax. In the first the point of perforation remains open, so that the air on respiration passes in and out of the pleural cavity; for example, in stab wounds, empyæma after pleurotomy, and

the rupture of an empyæma into a bronchus. In the second variety the opening leading to the pleura becomes closed, and the air in the pleural cavity remains stationary, or, at least, is not perceptibly increased or decreased by respiration. This condition may result from either cicatricial, adhesive, exudative, or other mechanical conditions which favor the occlusion of the orifice, and consequently may be observed in many conditions. In the third variety—valvular pneumothorax—the orifice is opened during inspiration and closed during expiration. Under these circumstances it is easy to conceive that the most distressing symptoms are likely to follow, since the intrapleural tension progressively increases through the constant addition of air, and finds no relief in an expiratory escape.

The symptoms that follow the admission of air into the pleura depend mainly upon the rapidity with which it takes place, upon the causes that give it birth, and upon the condition of the patient at the time of its occurrence. The mechanical effects of a sudden reduction of the respiratory area produced by the compression of the lung immediately give rise to symptoms that call most urgently for relief, and if the patient survives the primary shock and succeeds in accommodating himself to his reduced respiratory capacity, we subsequently observe that to the primary symptoms are added those of the pleuritic inflammatory disturbances with serous, purulent, or hæmorrhagic exudations that follow the inoculation of the pleura with pyogenic or saprogenic bacteria.

As the condition presents itself suddenly in the vast majority of cases—*i. e.* in consumptives—the principal symptoms of pneumothorax are sudden acute pains in the side, attended with great dyspnœa and shock. The countenance is anxious, distressed, and cyanotic, especially as the dyspnœa increases to orthopnœa. There is sometimes collapse, especially when a large vomica bursts in the last stage of phthisis. The pulse becomes frequent (140), feeble, and small, the respirations relatively more frequent than the pulse, and the voice feeble or suppressed. There is occasionally great hyperæsthesia of the affected side. The temperature sinks below normal. The patient either lies upon the affected side to allow the healthy lung to expand with more freedom, or sits up with the elbows or hands resting upon his knees. The patient is sometimes conscious of something giving way. All the symptoms of pneumothorax may be most closely simulated in an attack of acute pulmonary congestion supervening upon already advanced disease (Powell). On the other hand, there may be almost an entire absence of any special symptoms to mark the onset of the attack. The physical signs, however, decide the diagnosis: there is marked barrel-like bulging of the affected side; the heart, diaphragm, and liver are notably displaced, according to the side which

is affected. Percussion at once elicits a characteristic hyper-resonant (tympanitic) note; the respiratory murmur is absent or very feeble; amphoric breathing may be heard, accompanied by metallic tinkling. Auscultatory percussion reveals ringing, clanging noises (*bruit d'airain*), etc. When the pneumothorax is complicated with purulent or other effusions the Hippocratic splashing sounds, together with the other physical signs characteristic of these exudations, are added to those which are especially diagnostic of the presence of air in the pleura.

From the preceding synoptical sketch of the etiology, pathology, and symptomatology of pneumothorax we may classify the therapeutic indications of this complex condition into the curative and symptomatic. Before proceeding to the discussion of these indications, it is very important that we should lay down a fundamental pathological distinction which must exercise a profound influence upon our therapeutics. As has already been stated, there are cases in which pneumothorax develops in persons apparently healthy: this occurs usually at the most vigorous period of life (seventeen to thirty-seven years, Gaillard), when, as the result of a violent effort, the pulmonary vesicles give way and the air is admitted into the pleura. The pleura is in these cases healthy and the physical signs are strictly those of pneumothorax. Nothing but air, and possibly a little blood, are admitted into the pleura from the ruptured lung; furthermore, the air admitted, being filtered by its passage in the lesser air-passages, is *germless*. The conclusion from this is that no inflammatory reaction, no pleurisy, follows the entrance of the germless air into the pleura, and consequently no apprehension need be entertained from the accident, excepting on the score of the purely physiological effects of the mechanical displacement of the lung, which may, of course, be very serious, especially if both pleuræ are involved, as in a recent case (a parturient woman) reported by Otto Lazius. The benign course generally followed by these cases, which rarely call for therapeutic intervention after the acute symptoms are relieved, is well attested by the experience of Havilland, Hall, Rix, Del Grange, Biermer, Ricker, Fräntzel, W. Zahn, Gaillard, and others.

The acute symptoms which develop with the sudden occurrence of pneumothorax are due to shock, asphyxia, syncope, and exhaustion. The shock is due to the sudden lesion of a vital and most sensitive organ; the asphyxia, to the sudden suppression of a large part of the respiratory surface, especially in those subjects who (90 per cent. of the cases) are already lung-crippled. The syncopal symptoms are due to the overcrowding of the right heart and venous trunks with the blood that has been squeezed out of the collapsed lung; finally, the prostration is a natural consequence of the pain and intense dyspnœa which is superadded to an already exhausted subject. All these com-

bined indications are best met by the hypodermic injection of $\frac{1}{4}$ or $\frac{1}{2}$ of a grain of morphine and $\frac{1}{150}$ of atropine if the patient is an adult, or a proportionate dose if a child. This relieves the shock, the pain, and the dyspnœa; to this should be added liberal inhalations of oxygen to diminish the tendency to asphyxia, and the internal administration of the general and respiratory and cardiac stimulants, preferably ammonia, ether, camphor, strychnine, digitalis, strophanthus, caffeine citrate, etc. The mistura chloroformi et opii of the National Formulary,[1] or the elix. chloroformi comp. (one tea-spoonful equals 1 grain of opium and 2 minims of chloroform), or the original chlorodyne (Collis Browne's), are excellent preparations when the hypodermic syringe is not at hand, or when a stimulant sedative is to be kept up after the first hypodermic injection of morphine. A formula which would also meet the indications, and which has been frequently prescribed by the author, is the following:

℞. Tinct. moschi, f℥j;
Spts. ammoniæ aromat., f℥ij;
Spts. ætheris comp., f℥iij;
Tinct. digitalis, f℥j;
Elixir aromat., q. s. ad. f℥ij.—M.
Sig. One tea-spoonful every hour until relieved.

Another convenient formula for the same essential ingredients is:

℞. Tinct. moschi,
Tinct. camphor.,
Spts. ammon. aromat.,
Spts. ætheris comp.,
Tinct. capsici,
Tinct. digitalis, ā ā f℥ij.—M.
Sig. Sixty drops in one ounce of strong toddy.

Sulphate of strychnine ($\frac{1}{30}$ grain) every hour for two or three doses, or caffeine (1 to 5 grains) should be administered hypodermically when evidences of heart failure are dominant. In addition whiskey, brandy, or other stronger alcoholic is in order.

Usually, also, the use of stimulating embrocations to the skin, such as mustard plasters to the back, dry cups, bags of hot water, or a stimulating liniment, such as the linimentum ammoniæ or tincture of mustard with soap liniment, help considerably to relieve the immediate distress by cutaneous derivation.

[1] Each fluidrachm of which contains 7½ minims of chloroform, 7½ minims of tinct. cannabis. ind., 3¾ minims of tinct. capsicum, 1 minim of fluid ext. of belladonna, and about 1 gr. of opium.

In some cases the preceding measures afford only temporary relief; the dyspnœa, with marked cyanosis and feeble rapid pulse, continues to be a menace from asphyxia. The increasing barrel-like fulness of the chest and physical exploration explain the condition, which is manifestly due to increasing and unrelieved intrathoracic pressure. The only logical treatment is then to give a free exit to the pent-up air, and thus liberate the lung. Thoracentesis is in such a case the only means of securing relief. The method of performing it is of course a matter of some moment.

The operator must avoid three things: (1) The readmission of air; (2) the contamination of the contained air, especially if this has gained admission into the pleura through a healthy pulmonary parenchyma, as in traumatic cases; (3) the excessive reduction of the intrapleural tension beyond the point of giving simple relief, for fear that by allowing the lung to expand the original perforation will be enlarged and its healing interfered with.

Probably the best way of securing the desired result is by the use of the aspirator. An ordinary small or capillary trocar will do in the very urgent cases, especially if a piece of gold-beater's skin is stretched over the orifice to prevent the readmission of air. When relief is obtained the trocar can be removed, and the opening in the chest sealed with cotton saturated with iodoform collodion or with adhesive plaster. Care should be taken to do this thoroughly, otherwise a general subcutaneous emphysema may supervene which will give rise to serious trouble.

We have thus far considered the purely symptomatic or palliative treatment; now a few words as to *curative* measures that may be entertained for the permanent relief of the more favorable cases.

While the permanent cure of pneumothorax may be obtained in many cases, even of the worst type, the ultimate result will depend upon the nature of the cause that immediately led to the pneumothorax; and as this condition is almost always tuberculosis in the non-traumatic cases, we can readily understand the gravity of the final prognosis. In a general way, it may be stated that the final removal of the air from the thorax can be effected only by operative means, and these reduce themselves to thoracentesis with aspiration or pleurotomy.

In the open type of pneumothorax—*i. e.* that variety in which the intrapleural pressure oscillates with the inspiratory and expiratory movement—it is self-evident that thoracentesis cannot affect the condition except in those cases which are associated with either a serous, purulent, or putrid accumulation in the chest, as in those cases of empyæma or other form of pyothorax which burst by a large opening into a bronchus. Under these circumstances aspiration—or, better,

if the condition of the patient warrant it, a free incision into the pleura with or without resection of a rib, as in the manner previously described (*vide* Empyæma)—is the surest way of giving permanent relief. If it is a large tubercular vomica that has perforated into the pleura, death usually overtakes the patient before any such mode of relief can be contemplated, and palliation alone can be recommended.

In *closed* pneumothorax—*i. e.* in which the opening that has admitted air into the pleura is closed, and the existing pneumothorax is not reinforced by inspiratory efforts—surgical interference is most fortunate in its results. In the *aseptic* pneumothorax from strain, already referred to, the absorption of air takes place spontaneously; and in those cases in which the accumulation is followed by pleurisy with serous effusion (hydro-pneumothorax) or with pus-formation (pyo-pneumothorax) aspiration, followed, if the patient's strength allows it, by pleurotomy, is the best mode of relief.

In *valvular* pneumothorax (*a soupape*), which occurs almost exclusively in phthisical cases, and in which the greatest distress is caused by the continued increase of intrapleural tension from the constant additions brought in by inspiration, the operative indications will vary with the stage of tuberculosis in which the accident has taken place. In the advanced cases the immediate danger of asphyxia may be averted by aspiration or tapping if opiates fail. In the earlier and stronger cases aspiration may be resorted to with the greatest hope of success, not only as regards the cure of the pneumothorax, but improvement of the phthisical process. Here surgical interference must be resorted to with the greatest discretion. If aspiration is performed too early, great harm may be done by favoring the premature expansion of the lung and the consequent reopening of the pulmonary fistula which led to the original pneumothorax. On the other hand, if evacuation of the pleura is too long delayed, permanent and irreparable collapse of the lung may take place. The use of the manometer in conjunction with the aspirator is of great service, by informing the operator of the exact degree of intrapleural tension during the operation.

The following conclusions, from a recent and careful paper by Potain (*Gaz. des Hôpitaux*, April 26, 1889), may be regarded as a very modern and authoritative presentation of the indications for interference in pneumothorax. He says: "1. In the beginning, when pneumothorax does not give rise to marked dyspnœa, no surgical interference is indicated. 2. When by a valvular mechanism at the seat of the perforation the air accumulates in the thorax at a dangerous tension, which can be recognized by distension, by the displacement of the diaphragm and mediastinum, it is necessary to evacuate by puncture enough air to ren-

der the pressure within equal to that of the external atmosphere. 3. If a sero-fibrinous effusion occurs, abstain from interference as long as it is not dangerous from its weight or volume. 4. When the effusion passes this limit the fluid must be entirely withdrawn, in such a manner that the intrapleural pressure constantly equals the normal atmospheric pressure—seven millimetres of mercury. 5. If the effusion is sero-purulent, and not fetid, the same rule holds good. 6. But if the seat of the purulent accumulation communicates with a bronchus, or if the effusion is purulent and fetid from the beginning, it is necessary at once to operate as for empyæma if the opposite lung will be sufficient for the respiratory needs of the individual, notwithstanding the return of the diaphragm to its original position; but if this is not the case, and the respiration is bad and insufficient, introduce a syphon drain, which has cured many bad cases."[1]

[1] Witzel's method of removing an acute pneumothorax resulting from penetrating wounds of the thorax is worthy of remembrance in the treatment of this condition when resulting from pathological causes. This plan, which has been successfully carried out in Trendelenburg's clinic, aims at the conversion of the pneumothorax into an artificial hydrothorax, the latter being finally emptied by aspiration. The procedure is thus described in the *Centralb. f. Chirurgie*, No. 28, 1891 (also *Annals of Surgery*, Nov., 1891): "The bleeding having been arrested, a male metallic catheter is introduced into the pleural cavity through the highest points of the wound, its beak being parallel with the chest-wall. The wound is thereafter closed by sutures both air- and water-tight, with the exception of a little opening at the highest point. The pleural cavity is now generally filled with a solution of boric acid at blood temperature till all the air is expelled through the catheter, and all the fluid is removed by depressing the irrigator, which then acts as a syphon. The case treated in this way progressed very favorably."

ACUTE AND CHRONIC ORGANIC DISEASES OF THE HEART.

By W. H. THOMSON, M. D., LL.D.

UNLIKE other viscera, such as the lungs, liver, kidneys, etc., which contain within themselves the chief conditions for their specific functions, the heart is but a part of the apparatus of the circulation. Not only, therefore, will disorders of the heart affect the circulation, but the converse is equally important, that disorders of the circulation will affect the heart. We might even say that organic changes in the heart, however striking their signs may be, are serious only in proportion to the signs which accompany them in the circulation, and often it is the presence of the latter alone which leads us to judge that the heart must be wrong. Thus we have long ceased to regard the presence of a cardiac murmur as the chief symptom to establish either the form or the degree of heart disease; still less can it chiefly be relied upon for prognosis or as a guide for treatment. In a case of cardiac dropsy, for example, a physician could better be uncertain about the precise heart-murmurs which he hears than be wholly ignorant of the significance of the signs of general endocarditis and of the tense pulse of the patient. The consideration of heart disease, therefore, instead of resting at the cardiac valves, should include also a consideration of the whole circuit of the circulation. Physical examination of the arteries may afford as important indications of the nature of cardiac disease as physical examination of the heart itself; and the same may be said of signs observable in the venous, lymphatic, and capillary systems. The circulation in fact, is more extensive still in its course, for the rapid effects of a hypodermic injection show that the interstitial fluid outside the capillaries moves at a scarcely slower pace than the intratubular current, and many cases of labored heart-action, leading in time to serious organic changes in the heart, doubtless arise first in a disordered state of the interchange between the intra- and the extra-capillary fluids.

These facts receive a good illustration in the marked difference which exists between acute and chronic diseases of the heart. Acute diseases of the heart, like acute diseases in general, are of the nature of accidents, because their cause is usually external, such as infection

or exposure. Like accidents also, they are local in their seat, and commonly show a tendency to recovery, with or without certain special complications or sequelæ. Chronic affections of the heart, on the other hand, like most chronic affections, are not accidents, but are associated with wider and more general conditions, such as diffused vascular disease or affections of the lungs or kidneys. The treatment of these two classes of heart disease, therefore, often differs as much as the treatment, for example, of acute pneumonia and of chronic pulmonary phthisis.

We can begin, therefore, with the separate consideration of acute diseases of the heart, and we will take them in the order of their frequency in practice, rather than after any anatomical system.

ACUTE DISEASES OF THE HEART.

Acute Endocarditis.

This affection occurs most commonly from the presence of a ptomaïne in the blood, of which the chief is that which occasions acute articular rheumatism. Next to rheumatism, chorea should be ranked. Osler claims that chorea is associated even oftener than rheumatism with inflammation of the heart, but that its development may be so independent of the choreic symptoms that it may not be detected until months after these have subsided. Acute endocarditis occurs in scarlatina with or without rheumatic symptoms; also in measles, and less frequently in diphtheria. It also develops, generally in a subacute form, in both acute and chronic nephritis; of a severe type from corresponding septic absorption in pyæmia; and, again, of a mild type from less-pronounced sepsis in many affections characterized by ulcerative processes, such as typhoid fever, small-pox, phthisis, etc.

As in other acute inflammations, the tendency to local development is illustrated in acute endocarditis by its almost exclusive limitation to the left side of the heart. It would appear as if the inflammatory poison needed arterial blood for its efficacy, for in the fœtus the right side of the heart, which receives the arterialized blood first through its auricle, is as often attacked as the left. To this may be added direct impact, because at the aortic orifice it is the ventricular surface of the valves which is attacked, while at the mitral it is the auricular. The inflammation begins with a reddening of the valves, especially at their lines of junction, where rows of small granulations soon form which are quite analogous to those of an inflamed conjunctiva, and, like these, they soon become sources of further irritation of the smooth, rapidly-

moving lining on which they develop; with this difference, that in the heart the disintegration of the leucocytes which infiltrate the granulations leads to the direct deposit of fibrin upon them from the passing blood. By this means they grow into vegetations of more or less size, sufficient to extend the irritation by friction to the whole valvular surface, and then to the walls of the heart itself. In the case of long vegetations, reaching down into the heart, local ulcerative action may be recognized where the tips of the processes have come thus into contact with the contracting ventricular wall, which may lead even to a circumscribed abscess in the muscular substance. At other times this action is more directed against the root of a valve, causing an ulceration which may perforate it or sever its connection with one of the chordæ tendinæ, or so lead to distortion of the valve in cicatrization as permanently to damage its working.

In many cases acute endocarditis, owing to its limited area, begins with such moderate constitutional symptoms that but for auscultation its presence would not be suspected. Thus in autopsies of typhoid fever and of phthisical subjects it is found to have existed in some without having been detected in life. This fact, therefore, always should lead to frequent examinations of the heart in those acute diseases in which its occurrence is likely. Before auscultation reveals its beginning, however, I have often found, without there being any pericarditis, tenderness on pressure made in the epigastrium upward under the left arch of the costal cartilages at the end of expiration. The patients catch their breath, while the heart gives a few rapid beats from the pain produced. It is important to note that in children with rheumatism endocarditis often develops while both the joint symptoms and the fever are very moderate. Thus a boy, aged twelve years, two days after sitting on the cold ground watching a ball game, complained only of some stiffness of one knee and in the opposite ankle. I found his heart unaffected then, but the next day, though only the knee remained slightly inflamed, endocarditis had already begun, and continued to progress, while the joint symptoms steadily declined. No doubt, therefore, many cases of chronic heart disease, whose origin is unknown to the patients or to their friends, may have begun thus in some early slight rheumatic attack, whose pains were supposed to be of the variety termed "growing pains," and hence children who have passed restless nights with such pains should be frequently examined for cardiac symptoms.

As the inflammation progresses, however, an increase of fever and of pain, referred to the præcordium (by children to the stomach), with palpitation, is the rule. The expression also often becomes anxious, a sign of particular importance in children, as it differs so much in them from the expression of pain. The signs on auscultation in the ordinary form

of this affection are commonly systolic, rarely diastolic, murmurs, oftener at the apex than at the base, and not infrequently of a loud blowing character. The loudness of the murmur is no index of severity, for it is not as serious a symptom as a feeble murmur with disturbance of rhythm and unfavorable general symptoms. The duration of such an attack of endocarditis is very variable, but the prognosis, as far as the existing inflammation is concerned, is good; for the majority of such cases recover, without the patient being aware that a permanent mischief has befallen him. In many instances, however, the pulse remains frequent and the heart irritable for a long time afterward. Its physiological unrest is itself the cause of the delayed subsidence of the inflammation, and hence the difficulty of checking a moderate endocarditis in children, from their being allowed so commonly to get up too soon and to act like other children in their sports.

In more severe cases of acute endocarditis the pain, fever, and rapid or irregular heart-action may be much more pronounced, and the distress of the patient from them be very evident. But in other cases these symptoms may be comparatively slight and the temperature low, while the constitutional symptoms are very grave, resembling the terminal stages of typhoid fever, meningitis, or general tuberculosis. One manifestation, however, should at once suggest endocarditis instead of these diseases, and that is ecchymoses on the skin, with or without hæmaturia. These are due to a stream of fibrinous emboli sent into the circulation from their soft-clotted sources in the heart, the larger ones when arrested in some viscus often occasioning rigors with elevation of the temperature, so as to simulate remittent fever. The course of these cases may be prolonged for many weeks. The prognosis is bad: the pulse is rapid and feeble, the patient being sometimes much distressed with dyspnœa or attacks of syncope or other signs of the formation of heart-clots, while others die after severe cerebral symptoms, such as delirium or stupor, or with signs of intercurrent inflammation from infection of the lungs, liver, spleen, or kidneys. Recovery, however, does occur in some, even after they have shown ecchymoses quite extensively.

Treatment.—Naturally, the first indication is to deal with the blood-poison which is causing the inflammation. As regards the commonest agent of the kind, I have little doubt that heart inflammations have increased in frequency since the introduction of the salicylates in the treatment of rheumatism, compared with the time when the alkaline treatment was more generally followed. That a full, and not a partial, recourse to alkalies will render carditis in any form uncommon in all patients, except children, with acute rheumatism, I believe as implicitly as did Fuller himself. That either form of treatment has much advantage over the other in shortening the

real duration of the rheumatism is very doubtful. That the salicylates do relieve the accompanying arthritis the soonest and best no one can deny, but the blood most highly charged with them is just as likely to inflame the heart as it is without them—just as rheumatism in childhood shows that there is no necessary connection between the severity of the joint-symptoms and the liability to carditis. Not so the alkalies. When they are given promptly and with the one object speedily to alkalinize the urine and to keep it alkaline, the heart may be reasonably regarded as safe from serious attack. For this purpose it is not enough simply to give alkalies, but a relative excess of alkalies in the blood and in the secretions must be secured, and to do this may require persistent and free dosing for prolonged periods. For this purpose I prefer Garrod's treatment, with 40 grains of the bicarbonate of potassium and 5 grains of citric acid, every two hours continuously till the urine is not only rendered alkaline, but remains so for twenty-four hours, when the same doses may be given every three or four hours, according to the tendency to revert to acidity. By this medication, when in adults the symptoms of rising fever and of the extension of joint-inflammations point to approaching heart mischief, we secure not only prophylaxis, but also may arrest a carditis already begun. German writers (Traube, Leyden, Fraenzel) maintain that in acute rheumatism an actual dilatation of the heart may be demonstrated by the extension of the area of percussion dulness, without there being any endo- or peri- or myo-carditis present, and that on the subsidence of the rheumatism the heart regains its normal dimensions. If this be so, it indicates a tendency of the heart-muscle to be so weakened by the rheumatic poison that the resulting dilatation may dispose to valvular inflammation from strain by the impact of the blood-current when the valves are not yet adjusted to the dilatation, and the detection of this condition may afford another reason for an early resort to alkalies. Meantime, the alkaline treatment does not exclude the employment of the salicylates from the beginning for their analgesic effects, and therefore I long have been accustomed to prescribe the latter alone at the commencement of acute rheumatism, and then to diminish or to intermit their use so soon as heart-complications seem to be threatening.

Another indication in the treatment of acute endocarditis is to slow the beats of the heart itself. When, compared with other acute inflammations with similar symptoms, it is noted how insignificant are the structural changes which a rheumatic inflammation produces in other textures, it is evident that another factor besides the rheumatism is needed to explain the severity of the heart lesions. A knee-joint with the same amount of pain and swelling from any other cause of arthritis would probably not fully recover therefrom, while in acute rheumatism

it may part with its inflammation by transfer to another joint in one day. That factor which induces organic changes in the heart is indicated, doubtless, by the contrast between the joint kept motionless when it is attacked and the inflamed valve vibrating a hundred times and more a minute. This surmise is further borne out by the effects of the rheumatic inflammation in another unresting texture—the pleura; for rheumatic pleurisy resembles the cardiac more than the joint inflammations in consecutive damage.

To quiet the heart in endocarditis aconite is the preferable sedative, for its specific analgesic property renders it superior to the simply slowing action of veratrum viride. Five drops of the tincture every three or four hours, according to the effects, will often cause a marked improvement in the heart-symptoms, and if there be much pain Dover's powder is an excellent adjuvant to the aconite. In those cases with quick, feeble pulse and grave general symptoms aconite is contra-indicated.

Another measure, often not as sufficiently attended to as its relations to such an inflammation require, is protection of the surface. While there is no direct vascular connection between the skin and the internal viscera, the general law of a close relationship between the vaso-motor nerves of an internal part and that of the corresponding cutaneous area has many important therapeutic applications. On this law are based not only the uses of counter-irritation, but also those of all external applications in the treatment of internal inflammations. The quick start of the heart in health on a sudden application of cold to the præcordium is an illustration of this sensory association. But in all inflammatory states of internal organs this normal sensitiveness to cutaneous impressions is much increased. A person with an acute coryza will know that a cold draught is coming from some source which he would be quite unable to appreciate in his usual condition. There can be no doubt, therefore, that an acute inflammation of the heart can be much aggravated by a neglect to protect the affected side of the chest from chill. It is rare to have that region laid bare in health, either by day or by night, and yet I have seen physicians expose the chest of perspiring patients with acute rheumatism and a carditis to an unjustifiable extent and time while making their examinations; and on one occasion, I doubt not, with fatal result in a case of commencing pericarditis, in order that a class of students might hear the friction-sound. We should pursue instead the opposite course, not only by providing a special covering for the surface over the cardiac area, but also by the sedative effect of moist heat along with a variety of anodynes. Poultices mixed with extract of hamamelis and laudanum, and covered with oil silk, could be used by day, while at night it is preferable to saturate a flannel with linimentum opii 4 parts and

linimentum chloroformi and linimentum aconiti, each 1 part. I have also long found a recommendation of Dr. T. K. Chambers of great service, that all patients with acute rheumatic inflammations should lie between blankets. This gives relief at once to the tender joints, whose hyperæsthesia is much aggravated by the rubbing of the sheets when wet through, as they often are, with acid perspiration, while the blankets serve much better than sheets to prevent further rheumatic inflammation or relapses from chill. I have no doubt that perspiration, especially at night, is a potent cause of intensifying or prolonging an attack of rheumatism. Under the present sway of microbism the view is widely maintained now, especially in Germany, that acute articular rheumatism is a bacterial disease. But bacteria alone are not sufficient in any disease, else tuberculosis, for example, would be universal, and in rheumatism one condition is necessary for the supposed microbes to initiate this disease, and that is the chilling of the skin when wet. Acute rheumatism is therefore endemic both in cold wet climates and in dry deserts like Arabia, from exposure of the moistened skin to cold—a constant experience among their inhabitants. The Bedouin Arabs, to my personal knowledge, are exposed to great changes of temperature from the rapid radiation of the heat from the desert at night, so that, on going to sleep soon after sundown with a torrid temperature in their tents, they often awaken in the early morning with a wind so cold that a European would find a winter overcoat welcome.

The perfect protection of a patient with a rheumatic carditis from surface cold is therefore as important an indication as any other in his case; and for the same reason during the subsidence of the inflammation, when the heart remains irritable for so long a time, it is well to order a large belladonna plaster to cover the whole cardiac area. As remarked above, no case of carditis should be allowed to get up too soon. The progressive nature of the heart affection in this stage of subacute inflammation is too often illustrated by the after-history of those patients who cannot be persuaded sufficiently to avoid all influences which increase the frequency of the heart-beats.

In the treatment of the types of endocarditis described above, with grave constitutional symptoms, we have to rely mainly upon free alcoholic stimulation. Unless the temperature exceeds 103°, we may hope for benefit from 20-drop doses of the tincture of the chloride of iron. Quinine and the coal-tar derivatives are mischievous from their weakening effect on the heart. I had one case which seemed to improve remarkably from drachm doses of Labarraque's solution of chlorinated soda, given freely in milk and water. I was led to do this from my constant use of this medicine in scarlatina, and in which it also acts well on the cases with rheumatic symptoms. In the endocarditis occur-

ring in acute nephritis frequent warm baths seem to do good, not only to the renal affection, but also to the cardiac complication by their sedative effect on the heart.

Malignant Endocarditis.

Instances of this severe malady are not of uncommon occurrence in hospital wards, but three cases in private practice afford good illustrations of its protean symptomatology, as well as of its more common types.

A lad of fourteen was brought to me as a case of chronic ague, with extreme anæmia, of five months' duration. Though repeatedly examined by myself and by more than one distinguished consultant, yet no cardiac murmur or other heart-symptom could be found to account for the transient appearance of reddened spots on different parts of the body, generally in the neighborhood of joints, whenever he had one of his severe chills with fever and sweating, and which occurred usually every seven days. During the intervals his temperature was normal or subnormal. At last a chill occurred which was followed by the rapid development of endocarditis, pericarditis, high fever, delirium, hemiplegia, and death. A localized ulceration on the left aspect of the ventricular septum was the probable origin of his disease, as it would account for the long absence of valvular signs.

The second case began with a follicular inflammation, which developed into small abscesses in the tonsils of a middle-aged gentleman, and which, as usual with him in former attacks, was followed after a week by rheumatic symptoms in his joints, though never before had his heart been involved. At this time he was under great mental depression, owing to financial losses, and he soon showed such serious symptoms of prostration and excessive sweating that the diagnosis of malignant endocarditis was early made, though the only heart-signs were pronounced disturbance of rhythm and rapid, weak pulse. He became obstinately taciturn, and, after developing double pneumonia, he died comatose. It was the right side of the heart which became affected first in his case.

The third case was that of a gentleman, aged sixty, with chronic sclerotic valvular disease and dilatation of the left ventricle, who, by proper treatment, had recovered a few months previously from pulmonary œdema and general anasarca; but after a dysenteric attack, induced by careless eating, his heart-symptoms suddenly became aggravated. General dropsy rapidly developed, with great dyspnœa, followed soon by cerebral symptoms, and then by a most extraordinary appearance of ecchymoses over the whole body. After death the universality of these hæmorrhages in even mucous and serous membranes,

as well as in the parenchyma of the viscera, would suggest a sort of bacterial spray from the aortic orifice to account for them.

In this disease rheumatic antecedents are but rarely noted, and then, with few exceptions, only as long-past occasions of chronic valvular disease. Long-standing organic heart-lesions, however, of whatever origin, seem to be potent predisposing causes for developing the affection. Next come infective forms of pneumonia, with the further not infrequent complication of purulent meningitis. Next, traumatic infection from some external source, such as a slight wound in the foot from paring a corn, or from a furuncular inflammation, or from a phlebitis common in the uterus after abortion or in puerperal fever. In these the right side of the heart is first attacked, and the auricular surfaces of the mitral valves secondarily, with pulmonary complications as the rule. In some cases, however, the infective source is not discoverable. Nor can it be said that the microbic invasion has been demonstrated yet as of one specific kind, the commonest form found associated with purulent foci being the *Staphylococcus pyogenes aureus*. On the other hand, in many cases pus is found nowhere, either in the heart itself or in the affected tissues. The proposed name of "ulcerative endocarditis" for this affection will not cover all cases, as there are some in which no ulceration can be found in the heart. Usually, however, large fungous vegetations are found with extensive ulceration at their bases, or the ulcers may be clean cut and eroding, or perforating the valves or even the septum, or else by means of abscesses extending through the muscular parietes of the heart till a purulent pericarditis is induced. Meantime, the systemic symptoms are of all the varieties which the infected blood-current may induce in its circuit—sometimes pulmonary, sometimes cerebral, gastro-intestinal, renal, etc., rendering the diagnosis often a matter of guesswork, especially as these secondary affections may afford much more distinctive signs of their own than the heart itself does. The fever, when pronounced, which is not always the case, is of the pyæmic type, but in chronic ulcerative states it may closely resemble ague in its quotidian or tertian stage, or, as in the case of the boy above mentioned, of the hebdomadal type. At other times it has the characters of a remittent fever.

The disease can scarcely be otherwise than inevitably fatal, and the treatment therefore can be only palliative of the urgent symptoms.

Acute Pericarditis.

As fractures are classified by surgeons into simple and compound, not because the latter term implies more extensive or serious breakage of bone, but because a new element is introduced into the case by communication with the outside, so pericarditis may be termed simple when the pericardium alone is involved, and compound when there is

peri-pericarditis as well; for the course and ultimate results of the affection are much modified by such extension in the majority of cases. Thus, complete obliteration of the pericardial cavity by the adhesion of its two layers is not infrequently found at autopsies, without much appearance of damage to the heart therefrom; but, as will be shown in speaking of chronic diseases of the heart, adhesions of the pericardium to adjacent parts, such as the chest parietes, or to the pleura, often lead to progressive structural changes which entail the severest results of heart disease.

Acute pericarditis is most commonly induced by the causes enumerated above as those of endocarditis, such as acute articular rheumatism, etc. A neighboring pleurisy—more commonly, therefore, of the left side—may also be added. But the pericardium has its own inflammation besides in the form of a tubercular pericarditis, which may be entirely primary, though usually it is associated with a general tendency to tuberculosis of the serous membranes. It is curious that tubercular pericarditis is more common among elderly than among young subjects. In this form, as well as in those cases which occasionally develop in the course of scurvy and purpura, the accompanying effusion is apt to be bloody. In rheumatic cases the effusion is serous or sero-fibrinous; in nephritis, more watery; while it is purulent in ulcerative endocarditis, pyæmia, and endocarditis from extension of an empyæma. If life be prolonged long enough in purulent pericarditis, the pus finds an outlet in the most various directions, as would any other abscess in moving parts. Finally, pericarditis may be induced by chronic endocardial and aortic lesions, by new growths in the mediastinum or from the œsophagus, bronchial glands, etc., and by various traumatisms.

The temperature in acute pericarditis is not often high, ranging from 101° to 103°, and in chronic cases it may remain normal. At the beginning of the acute inflammation the changes are the same as in any other inflamed serous membrane. But ere long the rapid movements of the pericardium cause the exudation, whenever it is not quite fluid, to assume the "honeycomb," "shaggy," or "butter" membrane appearance, when the two layers are separated from each other, or it may show irregular rolls lying between free flakes. The effusion when liquid may be moderate in amount, or so abundant as to measure from a pint to a quart or more.

The symptoms of pericarditis depend upon the conditions, and hence the diagnosis may be either very easy or quite the opposite. When it occurs in acute rheumatism, for example, it may be only by auscultation that its presence is revealed. In the first stage, præcordial pain, as might be expected in the case of a tough membrane, is more pronounced than in endocarditis. When constituting more than uneasi-

ness or tenderness the pain may be described as cutting, tearing, or burning, and sometimes as radiating to the left shoulder or down the left arm, and it is often accompanied with nausea or vomiting. The pain also leads to restriction of the movements of the diaphragm, so that, though the patient moves his legs freely, he keeps the trunk perfectly still. Locally, there is tenderness on pressure over the intercostal spaces and left side of the epigastrium. A short, hacking cough is frequently present, which if continuous should suggest the further complication of diaphragmatic or lateral pleurisy. The pulse remains strong, full, and excited even when effusion has set in, and it is diagnostic to find these characters while the impulse is enfeebled by the interference of liquid in the sac. When the effusion, however, becomes sufficient to embarrass the diastole, the pulse alters remarkably. Palpitation meantime is very common.

In the first stage of pericarditis, however, it is by auscultation that conclusive evidence is obtained in the presence of the characteristic friction-sound. It may be heard most plainly where other murmurs are but rarely heard, as over the pulmonary artery at the base, or equally over both ventricles, but it distinctly fails to be transmitted in any direction away from the heart. Though double, yet its sounds are not exactly synchronous with either of the heart-sounds when these can be also heard, and it is more superficial than are endocardial murmurs. At first the friction-rub may be of a grazing character, then louder and more crackling, like the crumpling of paper, or creaking, though very rarely musical. It also often varies with position, being clearer when the patient sits up than when lying down.

With the increase of the effusion the symptoms generally become much modified. The pain moderates and the murmur disappears. The breathing becomes labored and shallow; the patient lies with the head high, or he may have to sit up. The expression becomes anxious, the countenance paler and somewhat cyanosed, the pulse more rapid, smaller, and weaker, and in bad cases quite irregular. The veins of the neck are enlarged as a result of increasing stasis, and they may show many undulations. Delirium is common, or the patient may become irrationally taciturn. The signs on physical examination are now dependent on the effusion. The apex-beat may hardly be detected by the touch, but be strikingly visible to the eye as diffused upward above the nipple, with a distinct undulatory movement. The præcordial region is bulging, the intercostal spaces widened or obliterated, with sometimes the further unfavorable symptom of cutaneous œdema, indicating probable diaphragmatic pleurisy. Percussion shows marked enlargement of the area of cardiac dulness, which may extend from the clavicle above to the diaphragm below, making a triangle with its obtuse apex at the sternal junction of the left first rib, one side passing downward

through and beyond the left nipple, the other more vertically midway between the right nipple and the median line of the sternum. An important sign is the modification of the boundaries by change of posture, increasing transversely when the patient sits up, and diminishing when he lies down; and it is further significant that the dulness extends beyond the position of the apex-beat. If the pericardial murmur continues now in any form, it is changed into irregular jogs, which are more numerous than the endocardial sounds, which may be distinctly heard, though distant and muffled. In fatal cases the failing pulse may seem to be suspended during inspiration or cough, while restlessness, especially of the arms, rambling, or maniacal delirium, and lastly—particularly in rheumatic cases—convulsions and coma, terminate the scene.

Recovery from pericarditis often occurs more rapidly and completely than from endocarditis, the whole course lasting not more than a week, and leaving no signs during the subsequent life of the individual. In other cases the absorption of the fluid is more gradual, and as its components solidify the friction-rub returns louder and coarser than before, so that a friction fremitus may be felt by laying the hand over the part. More pain may now again develop, with palpitation, but, as a rule, the gradual diminution of all symptoms is progressive, till, by more complete adhesions forming between the two layers of the membrane, the friction-rub itself disappears. The exudation becomes in time converted into an imperfect form of connective tissue, which may be thin and delicate or thick and tough, or even extensively calcareous. There are no means of certainly diagnosticating such simple adhesions during life, for, unlike external adhesions of the pericardium, they rarely give rise, except in the calcareous form, to definite disturbance of the heart's functions.

Treatment.—The dangers of the attack itself are greater than in endocarditis, and are due in the first place to the amount of compression of the heart by the effusion; secondly, to the greater tendency of pericarditis to involve the heart-muscle; and lastly, to the liability of extension of the inflammation to the pleura or lungs.

The indications, therefore, are to moderate the inflammation as soon as possible; and here, as in endocarditis, the rapid action of the heart is to be regarded as the inevitable and yet serious complication of the inflammation, and therefore it is the first thing to attend to. Pain is the leading cause of both the excited and the irregular cardiac beats which constitute the symptom of palpitation. Hence in the first stage of the affection, when the pulse is full and strong, opium and aconite are invaluable, and should be given in full doses according to the age of the patient. When the effusion begins to tell on the circulation, they should be given up. Hot anodyne fomentations

covered with oiled silk should likewise be assiduously continued until the symptoms of the second stage begin, when they too should give place to the application of mercurial ointment with a flannel under the oiled silk covering. This old-fashioned remedy is of real service, in my opinion, throughout the subacute stage of the inflammation, and for a long time afterward in cases of external adhesions. In the acute stage German writers generally advise the application of the ice-bag. My experience with it has not been favorable after giving it a fair trial in hospital practice. When the effusion weakens the heart, digitalis and stimulants, like drachm doses of Hoffman's anodyne, with whiskey or brandy are required. The pulse-characters should be our guide rather than the signs of effusion alone, for accompanying myocarditis may be the cause of the flagging pulse and of the cyanosis, while the area of cardiac dulness may be but moderately increased. All except the most necessary movements of the patient should be avoided, for it is often noticeable how long the increased frequency of the heart-beats continues after such exertion as sitting up occasions, and which, when the pulse is irregular, may cause fatal syncope. When the effusion seems stationary, and not before, a blister to the whole præcordial region is often very beneficial, but it should not be prescribed in nephritis, for the tendency to effusion then is not from the local inflammation only, but is part of a general condition. In rheumatic cases the alkaline treatment should be persevered with, but all salicylates stopped.

If, however, the symptoms due to the effusion increase, an exploratory introduction of a hypodermic needle should be made, with proper antiseptic precautions, in the fifth interspace near the sternum, but not too near, on account of the internal mammary artery. This preliminary operation is needful, for we cannot be certain otherwise of the degree of removal of the heart from the chest-wall by the fluid. If fluid be withdrawn readily, we then can use the aspirator without fear; and it is often striking how a moderate abstraction suffices to improve the whole aspect of the case. Experience has shown that the dangers arising from puncture of the heart itself are but slight. For purulent pericarditis nothing else than evacuation of the contained fluid can be done, and if the aspirator fails a proper trocar and canula should be used.

The after-treatment of pericarditis should be according to its exciting cause. Restoratives of all kinds are indicated, except that in every form of rheumatism iron is mischievous, while in nephritis it does good combined with tincture of nux vomica and sweet spirit of nitre. It is only in convalescence that the iodide of potassium has seemed to me beneficial; it should be given in small doses, not more than 5 grains, and long continued. I have thought that it allays a tendency to pal-

pitation, and I give it in combination with the tincture of belladonna. Nothing, however, so quiets the heart and improves the symptoms of patients convalescing from any form of carditis as to have them wheeled out in mild weather to spend hours on a porch or verandah.

Tubercular Pericarditis.

This affection may develop suddenly as a primary disease, but otherwise it is not always easy to make out its existence. The effusion is often bloody, as previously stated, and the exudation may be so soft that it produces no positive sound. The patients very commonly have tubercular pleurisy as well, and in any case this form of pericarditis is prone to become complicated with external adhesions. If cardiac symptoms, such as great weakness of the pulse, cyanosis, and more dyspnœa than the pulmonary lesions will account for, develop in patients with well-marked phthisical tendencies, we may suspect tuberculosis of the pericardium and watch for the signs of effusion, etc. The application of a blister is indicated in this form particularly, while the case is otherwise treated according to the special symptoms present.

Hydro-pericardium.

Simple dropsical accumulation in the sac, without inflammation, does not occur as an isolated affection, but in conjunction with similar collections in other serous sacs, and therefore most commonly in chronic Bright's disease with anasarca. I have seen it, however, quite pronounced when there was but a moderate collection in the adjacent pleura. It may then have occurred as the result of a low grade of inflammation which was not enough to affect the temperature. The treatment should be that followed for the general disease, together with the local application of mercurial ointment.

Acute Myocarditis.

This is a very different affection from the so-called chronic myocarditis or chronic fibroid disease of the heart, and it consists of a true acute inflammation of the muscular walls, so that the fibres become softened, and under the microscope show the characteristic changes of inflammatory processes in muscular tissue. It is a not uncommon accompaniment of acute pericarditis, and to a less degree of endocarditis, but it is then generally limited to the muscular fibres most adjacent to the inflamed membrane. As previously mentioned, it may consist of a localized extension of ulcerative endocarditis, with abscess-formation, but in any case this associated myocarditis is not recognizable by physical signs, and can only be inferred by its occasioning more weakness of the heart's action, with dyspnœa and cyanosis, than the primary disease seems to account for. Acute myocarditis, however, undoubtedly

does occur in some cases by itself without either endo- or pericarditis, as has been shown by G. West in England, and Koster, Ruehle, and Leyden in Germany. The cases reported, with confirmation by autopsy, mostly occurred in connection with acute rheumatism, or else were associated with cirrhosis of the liver in drunkards. The symptoms during life which led to the diagnosis were accompanying acute rheumatism with serious heart symptoms, without signs of valvular or pericardial implication, or without rheumatism, yet with the same symptoms of great cardiac dyspnœa, cyanosis, weak heart-action, and delirium. As cirrhosis of the liver is particularly apt to be accompanied by degeneration of the muscular tissues generally, it is probable that this condition may occasionally take on an acute form in a heart previously weakened by alcohol, but the frequent presence of acute rheumatism in the cases reported leaves no doubt that a true primary myocarditis may be set up independently in rheumatic fever; and Ruehle claims that this happens oftener than is generally supposed. That myocarditis may be the chief cause of the fatal course of a rheumatic endo- or pericarditis is readily granted, but as a separate affection it certainly is not common in this country. The recognition of its possible existence, however, is serviceable if only to prevent a too exclusive reliance on physical signs in the diagnosis and prognosis of heart affections. The absence of murmurs or of increased area of dulness on percussion should not cause us to rest easy in the presence of cyanosis and of failing, irregular pulse. The treatment of this affection is of course the same as that of like conditions in other cardiac inflammations.

CHRONIC DISEASES OF THE HEART.

A CHRONIC structural change in the heart resulting from an acute process is not always synonymous with chronic heart disease. Thus acute endocarditis occasions a variety of changes in the mitral and aortic valves which long may indicate their presence by their characteristic murmurs, and yet in time these may wholly disappear. That many such cases outgrow the valvular trouble, especially mitral lesions, there can be now no doubt. The majority even of those in whom valvular murmurs permanently continue do not have their health unfavorably affected for years, and in many of them the duration of life is not appreciably shortened. Sir Andrew Clark reports 684 cases of chronic valvular lesions in his own experience which had been observed for five years, without the health having been disturbed by the state of the heart. An old valvular damage, however, soon becomes a serious matter when certain influences or states begin to

strain the heart, and hence in no class of diseases is it so important to take account of the general, in distinction from the special or local, conditions as in chronic diseases of this viscus. Thus, judged by post-mortem appearances alone, it may be difficult to decide whether the valvular changes were the chronic results of acute processes, or were caused by acute processes supervening upon chronic lesions. But the clinical history and aspect of the case will afford valuable assistance toward estimating the share of intra- and extra-cardiac influences in producing the symptoms, as well as their order in time; and hence we prefer to classify the various chronic affections of the heart into the primary, or those caused by some lesion in the heart itself, and secondary, or those which are produced by disorders of the circulation.

Chronic Valvular Disease.

Chronic primary valvular disease may arise from an endocarditis during fœtal life, the right heart being then liable to attack, as previously stated; so the commonest congenital form of valvular heart disease is either incompetence or stenosis of the pulmonary valves. As articular rheumatism, chorea, and scarlatina are commonly affections of childhood or of youth, so primary valvular heart disease oftenest occurs before thirty years of age, to give place then to progressive liability to the various forms of secondary valvular disease. Of the primary forms, mitral incompetence is the most frequent, aortic stenosis the next, mitral stenosis the next, and aortic incompetence the least frequent. In the order of seriousness there is little difference between them, when the valvular damage itself is moderate; but when it is considerable, much the worst valvular disease is aortic incompetence, next mitral stenosis, next mitral incompetence, and last aortic stenosis. As the chronic inflammatory processes induced through the imperfect working of the valves by the initial inflammation scarcely can be limited to only one aspect of the valves, so it is very common to find them result in both stenosis and incompetence of the affected orifice. Thus, mitral stenosis may begin with an inflammation of the auricular surface, which unites the edges of the two segments by a growth of connective tissue, sometimes infiltrated also with calcareous matter. This process, however, may extend to the chordæ tendineæ below, and mat them together into a fibrous cord whose contraction draws the valve down into a funnel shape with a small slit in it, constituting the "buttonhole" mitral, reducing its opening to one-third its normal size. But, on the other hand, the effect on the chordæ tendineæ may be the reverse of this, for they may become so elongated that they allow the valves to flap back, with consequent regurgitation into the auricle. Other contraction changes in the valves may keep them open, and yet narrowed in both systole and diastole, with the production of

double murmurs accordingly. The sigmoid valves of the aorta may undergo the same changes, so that aortic regurgitation is very commonly preceded by a stenotic murmur. The valvular changes in aortic incompetence, as a rule, are more extensive than in any other form of valvular disease, owing to the great force of the recoil of the aorta, especially as this increases with age. The slow inflammatory process may then extend to the aorta itself, and with aortic dilatation we may find a valve so thickened and distorted that it is turned into the semblance of a large vegetation flapping back and forth in the blood-stream, with a distinct musical vibration.

The effects of these lesions will vary, of course, according to the valves involved and the extent to which they are altered. The systemic effects of mitral lesions are ultimately those of failure of the right or venous side of the heart, with the intermediate stasis of the pulmonary circulation added. In a case of primary disease of the right heart from pulmonary emphysema and old bronchitis the liver becomes chronically engorged, so that its lobules show the "nutmeg" appearance caused by a white zone of fatty cells enclosing red-and-yellow-looking tufts of hepatic and portal capillaries and distended bile-ducts. It is this condition of the liver which gives the yellow tinge to the complexion of such heart-disease patients. As a further result of portal embarrassment there are also gastro-intestinal symptoms, such as flatulence, anorexia, and heaviness after eating, constipation, and hæmorrhoids. The urine is diminished in quantity from a like condition of the kidneys, but it is important to mention that it may be quite albuminous, with numerous casts. The albuminuria and the casts may soon disappear with the improvement in the heart. The enlargement of the liver affords, besides, an indication that the kidney affection is not primary, but is due to the embarrassment of the heart; for in cases of original Bright's disease associated with consecutive heart disease the liver is not much enlarged, if at all. Finally, the increasing venous stasis tells upon the external circulation. The ankles begin to be œdematous; then the dorsum of the foot; and an ascending dropsy ere long reaches the body, with ascites and general anasarca, from which the face may or may not be wholly free, according to the state of the kidneys. These disorders in the return circulation may follow disease of the right heart alone, the left cavities then being small and contracted because of the diminished flow from the lungs, so that the general arterial circulation is relatively lessened, with a correspondingly small pulse. It is, however, a more curable state than disease of the left heart, for the right heart both dilates and recovers from dilatation more readily than the left does. Hence the prognosis is more serious, if the right heart fails from disease of the left, when the pulmonary stasis against which it has to contend is of

mitral origin. In mitral stenosis especially the engorgement may be so great, with paroxysmal exacerbations, that a profuse hæmoptysis may occur, and blood be found after death effused in small scattered or in large masses in the lung-tissue itself. For some unexplained reason, these collections of so-called "pulmonary apoplexy" occur oftenest at the base of the right lung. A longer stasis may block the capillaries, so that the alveoli become almost obliterated, causing the dense heavy condition termed splenization of the lung, while a more chronic state still induces interstitial growth of connective tissue, thickening of the alveolar walls, deposit of pigment, varicosity of the veins, and atheroma of the pulmonary arteries, producing the appearance to which the terms "brown induration" or "brown indurated pneumonia" are given.

In mitral stenosis the pulse is characteristically small, and in bad cases irregular as well. The diminished quantity of blood in the left ventricle generally causes it to be small and contracted. If it be found hypertrophied instead, the presumption is that mitral incompetence occurred first, during which the ventricle enlarged, and that the stenosis developed afterward. The right ventricle, on the other hand, is always enlarged to compensate for the obstruction in the pulmonary circulation, so that with the smallness of the left ventricle the right may extend to the normal position of the apex-beat, causing the characteristic stenotic murmur to be heard more toward the middle of the sternum.

Mitral incompetence, which is the commonest of valvular lesions, may be caused by the structural changes above mentioned, or simply by the general distension of a dilated left ventricle. As with each systole a part of the blood regurgitates into the auricle, the latter chamber becomes distended with the blood received both from the lungs and from the ventricle; and hence with the succeeding diastole a larger quantity of blood than normal flows into the ventricle. This entails heavier work on the ventricle, and leads to its hypertrophy; but unless the regurgitation be too great, the blood sent into the aorta, if there be no stenosis there, is fair in amount and the pulse remains normal, but without tension, as this is prevented by the mitral reflux. So long as the right ventricle by its increased strength keeps up the resistance in the left auricle to the mitral regurgitation, the heart may go on filling the aorta so regularly, and the pulse be so natural, that this condition may last for an indefinite time without any sign save the mitral murmur to indicate its existence. Whenever the incompetence of the mitral, however, so increases that the right ventricle fails to balance it, or when the latter itself yields and dilates in turn from such an added strain as a bronchitis, then primary mitral

valvular disease shows all the results above described of venous embarrassment in the lungs and throughout the system generally.

Aortic stenosis is a common result of acute endocarditis, but is usually then not sufficient to produce serious obstruction to the circulation, as compensatory hypertrophy promptly follows and the pulse remains normal in most of its characters. It is quite otherwise in the chronic endocarditis of secondary valvular disease, especially in elderly patients, for the aortic orifice may have become very much narrowed by the thickened and calcareous valves, with the result of causing the pulse to be intermitting, small, and particularly slow, sometimes only from twenty-five to forty a minute. There may then develop symptoms of cerebral anæmia, such as vertigo, syncopal attacks, or epileptiform convulsions, which differ, however, from true epilepsy in being accompanied by a remarkable fall of bodily temperature. In both mitral and aortic stenosis, as well as in aortic incompetence, the imperfect supply of arterial blood leads very commonly to a general lowering of nutrition or emaciation, which presents a striking outward contrast to the swollen contour of patients with venous engorgement.

Aortic insufficiency may result primarily from endocarditis, and secondarily from chronic atheromatous or calcareous changes, spreading to the semilunar valves from the intima of the aorta. It may also follow upon overstrain, and hence does not occur among women as often as among men, especially those who have to lift heavy weights in their customary work. As previously remarked, the powerful recoil of the aorta tends besides to aggravate the reflux into the left ventricle during diastole, and as the quantity of blood thus accumulating in the ventricle from both its orifices is, on that account, constantly great, the tendency to hypertrophy and dilatation is the most pronounced in this of any of the valvular lesions. Secondary incompetence of the mitral valve is therefore very likely to occur, and, as this soon leads to hypertrophy of the right heart, the whole organ often grows to such a size in all its cavities as to merit the term "bovine," or ox heart. The effect of this condition of the left ventricle on the circulation is peculiar. The initial yielding at the origin of the aorta paralyzes the arterial tonus throughout the body; the great fulness of the ventricle causes an abnormally large amount of blood to be thrown into the aorta with each systole, whose unresisted wave can then be followed to the smallest arterial terminals. If the arm be flexed at the elbow, the brachial artery may be seen to move in its sheath along four to eight inches of its course. Even the color of the nails may be seen to vary with the pulse, especially on raising the arm, and an erythema of the skin produced by friction may similarly change its tint. Meantime, the large but very short pulse-beat, followed quickly by a sensation of collapse caused by the regur-

gitation into the ventricle, constitutes that characteristic variety to which the name of "water hammer," or Corrigan pulse, has been given. Such patients sometimes complain of anginose pains, referred to the region of the heart or radiating to the left shoulder and arm; but the irregularity of the arterial flow is most felt in the cerebral circulation, especially on suddenly rising, when sensations of giddiness come on, or dimness of vision, or syncopal attacks which may be quickly fatal. On the other hand, it is not uncommon for patients to live many years in active life without material discomfort and with a healthy look, for not until mitral incompetence complicates the case is the complexion changed.

Stenotic valvular disease of the right heart is uncommon except as a congenital affection. Secondary tricuspid incompetence, however, is a frequent result of mitral lesions, and, as is usual with strained valves during the development of dilatation, the tricuspid may show signs of recent endocarditis at autopsies. The chief indication of the presence of tricuspid reflux is a venous pulse, to be seen in the jugular veins, especially the right, and to be felt sometimes in the liver by placing one hand on the epigastrium and the other in the right loin, when the whole organ seems to throb, probably because the liver veins have no valves, and thus easily transmit the cardiac regurgitation.

The symptoms due to the systemic effects of the heart lesions which have been described should always be noted first, before physical examination of the heart is resorted to, because they not only serve as guides to interpret the latter, but they may settle the nature of the case when the physical signs are relatively obscure or wanting. Systematic examination of a case of heart disease, therefore, should begin with the signs to be appreciated by the eye, then those which are detected by the sense of touch next, and those by the ear last. We should at first look the patient over. Simple anæmia and emaciation may imply pure mitral stenosis or aortic incompetence; extreme anæmia with ecchymoses, severe or malignant endocarditis. A yellowish tinge of the countenance and of the conjunctiva goes with tricuspid regurgitation, secondary to mitral disease, and this is still further assured by seeing the veins in the neck traversed by wavy pulsations. Entire absence of lividity suggests uncomplicated aortic lesions. A bluish tinge, especially of the lips, indicates failing propulsive power in the heart, which may be due to simple over-distension, to myocarditis, to the pressure of a pericardial effusion, or to mitral stenosis or incompetence. Visible arterial pulsation, especially at the bend of the elbow, is almost decisive of aortic incompetence. Œdema, beginning at the feet, indicates primary or secondary failure of the right heart as the origin of the dropsy, while its absence from the face suggests that the kidneys are not yet affected. Inspection then notes

the presence or the absence of the characteristic cardiac dyspnœa, with the consequent great difference in prognosis. Dyspnœa due to any form of pulmonary derangement, whether in the respiratory passages, lungs, or pleura, is invariably accompanied by a local or general interference with the lateral and antero-posterior movements of the ribs in breathing, and with an increase of the vertical movement instead. But in cardiac dyspnœa the ribs move naturally, and the patient acts as a person out of breath from running. The patient therefore does what he never does with any form of pulmonary dyspnœa—holds his breath from time to time to restore the rhythm between the action of the heart and the respiration, to the derangement of which his dyspnœa is due. He often closes his mouth to do this, whereas if he strives to check his breathing from pleuritic pain the mouth remains open. Orthopnœa is always due to bilateral embarrassment, and hence is absent in unilateral pleurisy, pneumonia, and phthisis, but present in croup, bronchitis, and asthma. It is therefore also present in severe cardiac dyspnœa, but the mobility of the chest at once distinguishes it from asthma or bronchitis. Finally, it may be regarded as a general law that when dyspnœa is caused by muscular exertion, it is far more indicative of cardiac than of pulmonary derangement. The signs accompanying the cardiac movements proper should then be looked for. There may be no apex-beat visible, or it may be displaced from its normal position an inch below and within the left nipple, to the right by a pleuritic effusion, or upward by abdominal distension, or it may be extended downward and outward by enlargement of the left ventricle, or to the right with epigastric pulsation in pulmonary emphysema, and by enlargement of the right ventricle, or it may extend upward above the nipple with a wavy appearance in dilatation of the left ventricle, and especially in pericardial effusion, while in extra-pericardial adhesions a remarkable alteration may be visible in a systolic retraction of the intercostal spaces and of the end of the sternum. Inspection then of the shape of the præcordium may show a uniform enlargement in all directions in pericardial effusion, amounting to true bulging of the part, rarely, however, with obliteration and widening of the intercostal spaces. Bulging may also be observable in the bovine heart of aortic incompetence in young subjects, but is rare in other forms of hypertrophy

Palpation should be begun with one finger at the apex, and the finger should then be carefully passed over the whole cardiac area to find the first sign of a thrill. The detection of one is a valuable aid to diagnosis, as its relation to the movements of the heart is more readily made out by the sense of touch than the rhythm of a murmur is by the ear. Thus the apex-thrill of mitral stenosis is easily felt to precede and stop with the apex-beat. The point at which a thrill is most sensibly felt should

be carefully noted, and then in what direction it does or does not continue to be felt. The conclusions from such palpation are quite as certain as those which auscultation affords, and the signs may be found either with the systole or before it at the apex, with the same limits or tracks of conduction as the corresponding mitral murmurs, or with the systole or diastole at the base transmitted into the aorta or down the sternum as basic murmurs are. In some stages of pericarditis a friction fremitus is best felt by the hand laid on the part.

Palpation also conveys much information with reference to the heart-impulse. Though widely visible in pericardial effusion and in pronounced dilatation, it is much less appreciable by the hand in these states. The contrast then with the push of a strongly hypertrophied heart weighs much in the diagnosis of effusion or in the prognosis of dilatation. In advanced cases of aortic incompetence the apex-beat may seem double, but it is soon perceived that the second stroke occurs during the diastole, and is the jog of the regurgitant stream from the aorta impinging against the ventricular wall, where, after death, a network of reticulated tissue is found developed on the spot which received the impact. On the other hand, the absence of impulse, either visible to the eye or sensible to the touch, and associated with a weak pulse, may be the only physical signs for the diagnosis of muscular degeneration of the heart.

Percussion does not render as much service in the examination of the heart as in the case of the lungs. This is due to the smallness of the area of the heart, which is not covered by bone or by lung-tissue, and, further, because the left lobe of the liver below gives the same note on percussion as the heart itself. Only the positive percussion indications, therefore, can be accepted, for absence of increased area of percussion dulness does not prove by any means that hypertrophy or dilatation is not present. As Fagge remarks: "One may find at the autopsy of a case of cerebral hæmorrhage an enormously hypertrophied heart, notwithstanding that a few hours previously it may have been impossible to detect any clinical evidence of such a condition, the organ having buried itself within the hollow of the left lung, so as not to come more widely in contact with the chest-wall than in normal circumstances." Fraenzel also says: "Percussion of the heart permits no conclusion with regard to hypertrophy. In the normal individual, in the most favorable event, we obtain dulness at the upper border of the third rib at the left edge of the sternum, which extends downward occasionally to the lower border of the sixth rib. Externally, this dulness extends, at the most, to the left mammary line. Only occasionally can the lower border be distinguished from the hepatic dulness. But in the normal state of the heart even these limits are rarely reached in all directions. But if they are exceeded, while at the same time we can

exclude disease of the adjacent organs, then the increased area of dulness must be attributed to an affection of the heart itself. If the dulness is increased in all directions, there is probably an accumulation of fluid in the pericardial cavity: in enlargement of the right ventricle there is increased dulness in that direction, and downward and to the left in enlargement of the left ventricle."

The method of percussion, however, has much to do with the information obtained. Only very light percussion gives trustworthy results, and the stroke on the plexímeter finger should be made on the nail. Using the middle finger-nail for this purpose at a spot of marked dulness, the stroke can then be made for comparison on the nail of the ring finger, moved from and to the fixed middle finger. In this way the gradations of resonance can be easily appreciated. In most persons, however, with large, full chests, still more when the lungs are emphysematous, the heart is too much removed from the chest-wall to render percussion of much avail.

From the date of the discovery of auscultation physicians have grown accustomed to regard it as the great and chief means of diagnosis of disease of the heart, on account of the accuracy of its indications. So it still is, but it is a mistake to consider it as all-sufficient. Its signs may be quite misleading, as when typical murmurs exist during life in a case of simple distension of the left ventricle in Bright's disease, but in which the valves may be found, post-mortem, quite healthy. Leyden says that loud murmurs are of better prognosis than feeble ones, and often the worst cases are those where auscultation fails altogether. It is, moreover, of much importance that auscultatory signs should be observed in a systematic order, so as to note the easiest determined first and the most difficult last. Thus, to a beginner it may well be embarrassing to settle the rhythmic succession of the sounds which he hears. Instead of the 14 to 16 respiratory sounds a minute of pulmonary auscultation, he may have, in a case of combined endo- and pericarditis, 72 murmurs replacing the heart-sounds in the same time. When to this element of number irregularity of rhythm is added, it is plain that the relations of the sounds or murmurs to the systole and diastole respectively may be impossible to decide without previously obtaining the aid of the other elements in auscultation. The first observation to note, therefore, when a murmur is detected is the exact locality where it is heard plainest. If more murmurs than one are present, then where each of these is heard plainest should likewise be settled, for this often decides not only that there is more than one murmur, but what kind of murmur the first one noted is. The next step is thus made easier—viz. to determine in what directions the murmur is or is not transmitted. With these two points well determined, the question of rhythm then nearly settles itself.

Mitral murmurs have the apex for their region of greatest intensity. An apex-murmur which is conducted to the left, under the axilla, and is likewise plainly audible at the left of the spine about the second dorsal vertebra, while it grows less distinct toward the base of the heart, is, without doubt, a systolic regurgitant murmur. But an apex-murmur which is not transmitted in these directions, but grows less distinct toward the axilla and toward the base, is most likely the presystolic murmur of mitral stenosis. It might easily be mistaken for an aortic diastolic murmur, as this may be transmitted to the apex, and, moreover, both these murmurs occur during the diastolic period; but the seat of greatest intensity of the aortic diastolic is never at the apex, but down the sternum, or even at the base, and it is generally heard also in the aorta. The two mitral murmurs differ also, as a rule, from each other in other respects. The stenotic is rather harsh or grinding, but ends abruptly with a click, which marks the systolic closure of the valve, while the systolic murmur of mitral incompetence is soft, or at most blowing or booming, in its note. With both these murmurs the second heart-sound is heard only at the base, and it is there significant of the embarrassment of the pulmonary circulation to find the note of the semilunar valves of the pulmonary artery at the left of the sternum sharper than those of the aorta more to the right. In some cases of mitral stenosis, or even in emphysema, the pulmonary valves cannot close as soon as those of the aorta, and we have a reduplication of the second sound, best compared to the double rebound of a hammer after the first stroke on a hard surface. A mitral stenotic murmur often varies in intensity, being louder if the patient is sitting up than when lying down, or according to the rapidity of the heart-beat. Its frequent disappearance as the patient advances in age or in disease has been the subject of some fanciful explanations, but it seems most natural to refer it to a relative removal of stenosis by dilatation of the ventricle; for this often widens the mitral opening enough to produce incompetence, without the valves being even diseased. An aortic stenotic murmur is easily recognized by its site of greatest intensity being the base, and then by its transmission to the aorta at the second right costal cartilage, and thence up the carotids. It is then also plainly synchronous with the heart-beat. A diastolic aortic murmur has its point of greatest intensity just below the base of the heart at the mid-sternum, and is transmitted either directly down the sternum or a little to the left. It is also transmitted into the aorta, but, of course, not so plainly as the systolic murmur. Its rhythm is more easily made out than the diastolic murmur of mitral stenosis, for it begins immediately after the systole ends, and occupies the whole diastolic period. When a double aortic murmur is found, the louder the first or systolic sound is of the two, the better the prognosis, although

if the diastolic murmur be prolonged it does not show so much disease as when it is very short, for this may mean that the blood is falling back into the ventricle with great facility.

Auscultation should also take note of simple modifications of the natural sounds. A weak first sound at the apex, with a too clear second sound at the base, is one of the signs of failing heart, as in fevers, the first sound being feeble because the ventricle is contracting feebly, while its quick relaxation causes the semilunar valves to flap back suddenly with a short snap. If only one sound is heard in fevers, it is the second sound. On the other hand, these signs are closely imitated in the cardiac hypertrophy of Bright's disease or in general arterial sclerosis. The difference is that the first sound in hypertrophy is muffled and prolonged, owing to the long stroke of the ventricle in forcing the blood into the over-full arterial system, while the short, sharp second sound is caused by the strong recoil of the distended aorta. The difference is further made more evident by the complete contrast between the impulse of the apex-beat and the opposite qualities of the pulse in the respective states.

Murmurs at the valvular orifices of the right heart are infrequent, and, with the exception of tricuspid regurgitation, are commonly congenital. Dr. Bradford Fenwick has collected 70 cases of stenosis of the tricuspid, with presystolic murmur, the majority of which were in young women who also suffered from mitral stenosis. The murmur was heard best over the fifth right costal cartilage, near the sternum. Tricuspid regurgitant murmurs are of a soft character, heard best at the right of the ensiform cartilage, but are always difficult to distinguish from coexistent mitral regurgitant murmurs. Pulmonary systolic murmurs have their point of greatest intensity at the base, close to the left edge of the sternum, and transmit toward the left clavicle. Venous murmurs, on the other hand, are quite frequent. In tricuspid regurgitation, with venous pulse, a systolic murmur may be heard at the origin of the descending vena cava in the neck. But much the most pronounced of the venous murmurs is the loud, continuous hum heard oftenest in anæmic young women, when the stethoscope is laid lightly on the jugulars just above the inner end of the clavicle. That it is in the veins is shown by its immediate arrest by pressing with the finger upon the vein above. In some anæmic patients systolic basic murmurs, transmitted into both the aorta and the pulmonary artery, are also sometimes heard. The various explanations of the genesis of these anæmic murmurs are too numerous to discuss, but their functional character is shown by their simultaneous disappearance with the anæmia.

An examination of a case of heart disease cannot be considered complete without a careful comparison of its indications with the state

of the arterial flow. The sphygmograph supplies a very satisfactory schematic representation of the relation of the action and states of the heart to the vibrations of the blood throughout the arteries, whether in health or disease, but its uses are not so much clinical as explanatory and confirmatory of the indications which manual examination of the pulse affords. The practising physician had much better rely on his sense of touch, which can be trained to note the conditions of the blood-current with a delicacy and certainty which no mechanical contrivance can match. But as in physical examination of the lungs palpation and percussion should precede auscultation, so a physical examination of the blood-vessel itself should precede that of the characters of its pulse-beat. To do this three fingers should be laid on the radial at the flexed wrist, and the vessel carefully palpated transversely and up and down its course. If the artery is in a normal condition, it cannot be felt as it lies in its sheath except by its beat. It may be felt instead as a smooth resistant cord or as a rough, hard, and crooked tube for some distance up the arm. In the first case, it may be only over full from obstruction to the outflow in the arterioles or capillaries. In the second case, it is not only over full, but its coats have become diseased and thickened with atheromatous patches, which in some patients give it the feeling of a string of beads. To determine whether it is simply a distended artery or a thickened one, the upper finger should then be pressed upon it, so as to stop the blood-current within, when, if it be only over full, the other two fingers no longer feel it as before, but if it is permanently thickened it is still perceptible as a hardened cord. The conclusions which this examination allows are not only of importance in cases of heart disease, but of many general conditions of the circulation as well, sufficient to affect the prognosis of a pneumonia or to suggest liability to hemiplegia. A diseased radial implies a general arterial degeneration, with extensive obliteration of arterioles. The skin in such a state of the circulation must be everywhere relatively anæmic, which it shows by its slowness to redden on friction; and, as the veins cannot receive the normal impulse of the heart through such an intermediate obstruction, the tendency to œdema on the supervention of an inflammatory congestion, as in pneumonia, is much increased. But it is on the work of the heart itself that the onus of the change is first and most felt, and besides this very probably in its nutrition, from disease of the coronary arteries on the one hand, and from extension of the same changes in the intima of the aorta to the semilunar valves.

The characters of the pulse may now be studied according to the six elements which enter into a pulse-beat. The first three depend upon the action of the heart; viz. its frequency, force, and rhythm —that is, whether the pulse be slow or rapid, strong or weak, regular

or irregular—while the other three depend upon the state of the vessel—namely (1) the size of the pulse, whether large or small; (2) its quality, whether it be compressible or incompressible; and (3) its length, whether the pulse-wave take a relatively long or very short time to pass under the finger. A seventh character of the pulse of a pathological kind may be added, the dicrotic, which in debilitated conditions, as in fever, is manifested by a reflux wave in the relaxed blood-vessel after the passage of the true pulse-wave.

The relation of the pulse to various valvular disorders has been already alluded to, but there is one pulse-character which merits a special mention on account of its bearing on the etiology of chronic heart disease; and that is the incompressible or high-tension pulse. It is very easily mistaken for a strong pulse, because the continued throb of the vessel after considerable pressure is exerted upon it gives the impression of a strength sufficient to force its way against obstructions, whereas, if the heart, the source of pulse-strength, be examined, it may be found quite weak. An incompressible pulse is solely due to obstruction in the outflow, just as one can stand on a hose if the stop-cock closes the water from escape. In an artery the outflow may be hindered by reflex nervous spasm of the arterioles, as in the hard pulse of peritonitis, or from irritant blood-ingredients, as in the hard pulse of gout, or from this with endocarditis added, as in chronic Bright's disease; and the general condition which leads to a continued high-tension pulse must necessarily, in time, lead to left-ventricle hypertrophy as the first in a long series of consecutive cardiac derangements. An incompressible pulse is also a long pulse, for the pulse-vibration is short only when there is no resistance to the flow.

Chronic Secondary Heart Disease.

The clinical history of many cases of chronic cardiac disease is that one who has never suffered from any form of heart affection before begins after he is forty-five years old to notice that he easily gets out of breath on going up stairs. In time this happens on comparatively slight muscular exertion, especially after eating. He concludes that he is bilious, because dyspeptic symptoms, with some sallowness, make their appearance; but finally some swelling of the feet alarms him enough to consult a physician. On examination his radial artery can be felt and rolled like a cord in its bed, while his pulse is long and of high tension. Auscultation of his lungs gives jarring expiration, with mucous râles at both bases. The action of the heart is labored—that is, the systole is long with a muffled first sound, and the impulse strong and diffused—while the second sound at the base is clearer than natural at both edges of the sternum; but besides an occasional irregular or intermittent beat there is no murmur or other sign of

heart disease. The urine is found to be abundant, pale, of low specific gravity, and occasionally with a little albumin and a few casts. Under proper treatment he gets better for a time, his breathing becomes easier, and all signs of œdema disappear. But after a while the same symptoms return, and he begins to have suffocative attacks at night, with more or less expectoration; his strength fails, his digestion is more impaired, albumin appears oftener in the urine, and the dropsy of the legs increases, till anasarca and pleuritic effusion, particularly on the left side, progressively develop. Auscultation of the heart still fails to detect a murmur, but, instead, the rhythm of the heart becomes very irregular, and a discrepancy develops between the number of the beats of the heart and those of the pulse at the radial, the latter being much fewer. The dropsy continues to increase along with the embarrassment of the breathing, until death supervenes. The heart is found, post-mortem, with the left ventricle greatly hypertrophied and the right less so, but the valves seem to be all right. If the ventricle, however, be stretched by the fingers to reproduce its state in life, which has been lessened by post-mortem contraction, it becomes plain that it was then so dilated that both the mitral and the sigmoid valves must have been more or less incompetent. Some writers term a case like this "idiopathic enlargement of the heart." We might as well say that the patient spontaneously died. The findings after death show, instead, that for a long time the left ventricle had a hard task to perform, and which for an unknown period it did perform so well, because it grew for the purpose, that the patient was not aware that anything was wrong. It was not until it began to be labor-worn, and, losing its tone, began to dilate, that he noticed his breathing growing short. The real, primary cause of the heart affection, therefore, was the condition which gave such high tension to the pulse.

A ready explanation, which has been widely received, of the arterial tension which leads to cardiac enlargement, is that it is due to general endarteritis. When one considers the extent to which the lumen of the arteries must be diminished, especially in the smaller branches, by the sclerotic and atheromatous changes which are often found so generally disseminated that immense numbers of the arterioles must virtually be closed by them, it seems as if the obstacle in the circulation to be overcome by the left ventricle must be equal to anything which a diseased valve could occasion, for no aortic stenosis could be more effective than such a general stenosis. But, unfortunately, some autopsies disprove the sufficiency of this hypothesis in both ways, for cases of general sclerotic and atheromatous arterial disease have been found without any cardiac enlargement accompanying them, and cardiac enlargements, on the other hand, have been as often found without any arterial changes. The cardiac enlargements, however, always had

high-tension pulse in the clinical history, whether the arteries were diseased or not. On this account, Traube, who at first advocated the endarteritis theory, gave it up, and, instead of regarding the heart disease as caused by the arterial disease, regarded them together as due to a more general cause. Fränzel suggests that some unknown ptomaïne in the blood may be the primary cause of the high tension, and this, in turn, may be the occasion both of the endarteritis and of the heart disease. Without further discussing these theories, it is worthy of remark that in chlorosis we have a high-tension pulse, and, very often, cardiac hypertrophy, which disappears when the chlorosis is cured. Why cannot the circulatory difficulty in this case be in the capillary circulation, on account of the interference with the interchange between the capillary and the extra-capillary or interstitial circulation, due to the oxygen of the blood being altered? The extra-capillary circulation is, for nutrition, the most important department of the whole circulation; and that this may be itself the seat of the circulatory embarrassment on account of changes in the blood is rendered very probable by all that is known of the condition of the blood in cases of high-tension pulse, such as in gout, lead-poisoning, and renal disease. These are each conditions of blood-poisoning which can easily be conceived of as primarily deranging the osmotic function which capillaries subserve; which, it should be remembered, is not merely to conduct the blood, as the larger vessels do, but to exchange inflow for outflow with the interstitial current. This was the original hypothesis of Bright himself, to account for the frequent coincidence of heart disease with kidney disease, and I do not see that any subsequent theories have improved upon it. Muscular tissue is present in tubular structures only to move something out of them, and the increased tonus of the arterioles means that there is obstruction—not in them, but in the capillaries beyond; and a general blood-contamination disturbing capillary osmosis will therefore raise the whole arterial tension, with the effect of increased heart-labor, without arterial disease necessary anywhere. This blood-contamination, however, is very prone to set up inflammation in the intima, not only of the arteries, but, as has been shown by Arthur V. Meigs, in the veins as well, so that, doubtless, arterio-sclerosis, while not sufficient to account for all cases of these forms of secondary heart disease, yet is a serious complication of the original cause of the cardiac affection.

High-tension pulse is found in every form of structural kidney disease, invariably in the contracted kidney, less invariably in the large white kidney, still less in waxy degeneration and in pyelo-nephritis; and consecutive heart-change is present in the same ratio in these different renal affections. But in addition to the arterial obstruction the toxæmia of Bright's disease is often a direct cause of endocarditis, some-

times of pericarditis as well, so that the usual ante-mortem symptoms and post-mortem findings of valvular disease, already described, are the rule in these cases. Besides developed kidney disease, persons with the uric-acid diathesis are prone to become short-breathed and to suffer general arterial change from an accumulation in the blood of imperfectly oxidized products of retrograde metamorphoses. Over-indulgence in eating, and still more in drinking fermented liquors, whether wines or beers, with sedentary habits favoring portal stasis, may develop all the train of the results of cardiac dilatation on the supervention of some extra-cardiac strain, as a bronchitis, or after some cause of general enfeeblement. With many others the tendency to heart disease, from the same circulatory conditions, is as plainly hereditary as a tendency to apoplexy. In Bright's disease the hypertrophied left ventricle often fails in power before the hypertrophied right ventricle does, with the result that the latter may overwhelm the lungs with more blood than the weakened left can dispose of. Attacks of a suffocative asthmatic kind, with profuse expectoration of blood-streaked mucus, may occur, or a more chronic condition of combined cardiac and respiratory dyspnœa from pulmonary œdema continue with great aggravation of the patient's distress. At other times Cheyne-Stokes' respiration may develop, when it is of worse prognosis than in most other conditions in which it is observed.

Heart Disease from Bodily Strain.

Badly-fed and under-nourished laborers, whose occupation entails carrying heavy loads up ascents, are prone to suffer from dilatation of the heart, coming on gradually without valvular disease, but ending in much the same way as the forms secondary to vascular disorder just described. To lift a heavy weight a deep inspiration is first taken, and then the expiration is suddenly stopped. The extensive muscular contraction which then follows while the breath is held forcibly empties the veins into the heart. It is easy to see that both ventricles must suffer distension from such an access of blood coinciding with an interruption of the respiratory rhythm, and, if the general muscular nutrition is weakened by insufficient food and unhealthy drink, a constant repetition of such acts will naturally lead to dilatation of the heart. Occasionally cases occur in which acute distension of the left ventricle results from some one act of over-strain, as in a hospital patient of mine, a young, athletic ice-man, when attempting to throw a large block of ice along a sidewalk. He was seized with an intense pain in the cardiac region, which radiated down the left arm, and he fell breathless to the ground. On admission he was scarcely able to speak, he had a constant short cough, and was deeply cyanosed; the percussion dulness extended half an inch outside of the nipple line, and a

diastolic murmur was present. In three days these physical signs had so diminished, and the patient felt so well, that he could not be persuaded to stay in the hospital, but left to resume his work. This was a dangerous proceeding for him, as the rule is that acute strain, unless time enough is allowed for recovery, sets up a chronic irritability of the heart which ends in incurable dilatation.

It is often asked of physicians whether athletic exercises, such as boat-races, football games, etc., so popular now with young collegians, do not entail risk of heart disease. There is no doubt that the severe preparatory training which many of them take would be dangerous to certain constitutions, for the profession has been made familiar with the results of such muscular strain by the treatises of DaCosta in this country and of English and German writers on the irritable heart of young soldiers, which is induced by prolonged drill and marching with too confining or heavy accoutrements. After a slight attack of diarrhœa or fever, the soldier on returning to duty soon finds that he suffers with palpitation or faintness, and he is returned to hospital with pronounced and obstinate disturbance of the heart's action, such as dyspnœa and rapid pulse, much increased by standing, and with failure of circulation in the extremities. If this state be not remedied by prolonged rest and proper treatment, what seemed at first to be but a functional derangement ends in permanent organic heart-damage, both valvular and muscular.

Muscular Degeneration of the Heart without Dilatation.

We prefer this term to "fatty" degeneration, because the group of symptoms which belong to the affection indicate a heart weakened by a muscular degeneration which may be fatty, and also may not be fatty, but something else. A patient just recovering from typhoid fever rises too quickly in bed, and thus induces fatal syncope. His heart is found, at autopsy, to be of a paler color than natural and of a soft and brittle texture, but the microscope shows nothing that resembles the real fatty degeneration of heart-muscle found in phosphorus-poisoning or in pernicious anæmia. So, in practice, we have patients who show symptoms of essential cardiac debility—breathlessness on exertion, cold extremities, weak but compressible pulse, and with no visible or sensible apex-beat, while auscultation reveals no murmurs, but only a weak and short first sound, with much the character of the normal second sound. Chronic symptoms of heart failure, such as flatulence, diarrhœa, dropsy, and orthopnœa, may successively develop, and yet the patient recover and enjoy good health for several years, and then die suddenly, as a patient of mine did whose father and brother had died in the same way. Another patient had quite recovered for two years from similar symptoms, but succumbed in a week

from acute dilatation of the heart brought on by a night's detention on the cars in New Mexico at an elevation of about seven thousand feet. The weakness in the heart-walls, which is the disease of these patients, has, however, different anatomical characters in different cases. In some there is a partial but marked fatty degeneration, associated with a diseased coronary artery. In others the fatty change is sufficient to be visible to the naked eye as fine yellow points or streaks crossed with darker striæ, especially in the papillary muscles. But it is after such acute affections as phosphorus-poisoning or myocarditis in diphtheria, or in severe chronic anæmias, as pernicious anæmia, that such typical forms are found; instead, therefore, of being an independent disease in them, it is a sequel to other morbid processes. On the other hand, cardiac muscular weakness, proceeding to a fatal issue, sometimes sudden, occurs as a constitutional affection in persons frequently with a neurotic family history, in whom no more appreciable fibrillar change can be found in the flabby heart-muscle than in some cases of fatal angina pectoris. In the autopsies of corpulent persons who have died with symptoms of heart failure deposits of fat are often found, under as well as over the pericardium, in such quantity as to suggest the hypothesis of invasion of the heart-muscle by fat as a distinct morbid state. This, however, is doubtful, as the heart disease is oftener explained by vascular and valvular disease being also present. There can be no doubt, however, that obesity, *per se*, is unfavorable to healthy cardiac tone by its interference with free respiration, and by its fostering the sedentary habits which weaken muscular structures in general.

Fibroid Degeneration.

This is a special morbid condition characterized by the presence of masses of hard white cicatricial tissue, found in the heart-walls, almost always of the left side. They can scarcely be said to be the results of endo- or pericarditis, for they may be imbedded in the muscular walls without either the endocardium or pericardium showing any connection with them. Sometimes they are so related to the endocardial surface as to suggest their origin from a circumscribed abscess arising, as already explained, in an acute endocarditis; at other times they appear on the outer surface as white patches, to which the pericardium is adherent, or they appear as numerous streaks of connective tissue distributed irregularly through the muscular substance. That they do not constitute a true fibroid degeneration of the muscular tissue itself, however, is evident from the normal state of the fibres themselves; and it is now determined that they are caused by obliteration of atheromatous branches of the coronary arteries by thrombosis, and consequent degeneration of the parts supplied by them, with the usual substitution, in time, of cicatricial tissue. Syphilitic disease of the coronary arteries is also

probably a frequent cause of the affection. The action of the heart may be much impeded by these tough structural changes in its walls, which occasionally produce such a local thinning of the ventricular parietes that pouch-like cavities, or so-called aneurisms of the heart, are formed.

As might be expected, auscultation can afford but little help in the diagnosis of this condition, as there are rarely any valvular signs. The symptoms are those of chronic circulatory embarrassment simply; the pulse is generally slow and intermittent, and the patient is very apt to sigh frequently. He is generally very despondent, from a sense of constant oppression in the chest, especially on exertion, and from general muscular debility. He may continue thus an invalid for years, and die finally with the usual developments of circulatory failure; or else he may expire very suddenly, as animals do in whom a large branch of one coronary artery has been tied, when for some time the beats seem to be but little affected by the operation, and then come to a sudden stop.

Extra-Pericardial Adhesions.

While the sequelæ of simple acute pericarditis, as previously stated, are not as serious as those of endocarditis, the same cannot be said if the inflammation involves the adjacent parts. If this occurs, the heart may become permanently fettered to the chest-walls, or to the mediastinal layers of the pleura, or to the diaphragm, or to the structures of the posterior mediastinum, with the most distressing after-effects, for the benign influence of hypertrophy, which counteracts obstructions for so long in other cardiac affections, is here, to a great extent, prevented by the irregularity of the heart-strains present and by their external seat. Primary dilatation of the cavities on both sides very commonly results, with cardiac pains and severe distress in breathing, general marasmus, and dropsy. When the adhesions with the pleura are extensive, we may have the *pulsus parodoxus*, so named because the heart-beats are affected by the movements of respiration. A left pleurisy or pneumonia, simultaneous with a pericarditis, is therefore of evil augury, and no effort should be spared to check their mutual interaction.

Treatment of Chronic Heart Disease.

The treatment of chronic heart disease should be clearly separated into the measures which are palliative and those which are curative in their nature. We may fail equally with either, but that does not affect the difference in the objects sought for in the employment of the two classes respectively. Thus, under the class of palliatives come all the nervines which are prescribed in the treatment

of organic diseases of the heart, such as digitalis, strophanthus, strychnine, caffeine, etc. Neurotics never affect structures, but only functions. The organic changes remain just the same as ever, no matter how long the remedies are administered, and all that should be expected of a nervine is that it relieves some symptoms of the morbid condition, but not the condition itself. This is according to the therapeutic law, to which there are no exceptions, that any drug whose specific medicinal effects can be secured by one dose cannot modify or affect a structural change. We refer to these principles of therapeutics here because there seems to be such a widespread reliance on drugs in the treatment of organic lesions of the heart, any one of which might be taken as long as is that powerful cardiac nervine, tobacco, without the most skilful microscopist being able to detect its effect on the heart-structure. In many cases of cardiac dilatation digitalis affords as much relief as stramonium does in many cases of asthma, but the hundredth dose of stramonium does not do more than the first did; that is, relieve the symptom, bronchial spasm, for the disease, asthma, remains as settled as ever. Nor can any other nervine do more than digitalis does with each dose for a certain number of hours—viz. stimulate the contractile function of the heart-muscle, the heart-muscle reverting to its old state as soon as the functional effect of the symptom-medicine has passed off. Therapeutically, therefore, all such remedies can be regarded only as temporary makeshifts, with the chances that ere long they will begin to fail and become less and less effective. The beneficial effects of digitalis are due to the cramp-like contraction which it induces in the heart, as it does in the other hollow organ, the uterus. It therefore lessens dilatation by interfering with the over-relaxation of the diastolic period. For the time, therefore, the heart has returned to its natural cavity-dimensions, with great consequent relief to all the distressful accompaniments of a heart which does not empty itself with each stroke. It is therefore not as serviceable when the diseased heart does empty itself with each systole as in the first stages of aortic regurgitation, when it has not yet dilated beyond compensation. The effect of digitalis on the pulse in a case of dilatation is often very striking, by its substituting slow regularity for the many ineffective contractions of the over-distended ventricle; and with such a recovery in the circulation we may expect the breathing to improve with the restoration of the cardio-respiratory rhythm, and with the chance thus given for the pulmonary œdema to be taken up. The hepatic stasis and the gastric congestion may be expected to improve next, and finally the kidneys will return to better work. The patient seems to improve in every respect, and hence this drug is often spoken of in terms which imply that it is *the* remedy for organic heart disease. It is an excellent adjuvant, but, like all nervines, it can be nothing more.

There is one disadvantage, however, in the action of digitalis, and that is that it acts on the muscular coat of the arterioles as it does on the ventricle, and thus raises the tension of the pulse. In many cases, therefore, we lose as much by contracting the already too-much-narrowed arteries as we gain on the heart by contracting it. This is particularly exemplified by the aggravation which digitalis occasions in the cerebral symptoms of Bright's disease.

We have one nervine, however, which can both counteract this undesirable vascular effect of digitalis, and at the same time promote its action on the heart, illustrating the frequent advantage of combining nervines which act alike on some nervous functions, but differently on others. That agent is nitro-glycerin, which promptly dilates the arterioles, while it stimulates the cardiac systole and for several years I have been accustomed, on this account, to administer it simultaneously with digitalis, as well as with other so-called heart tonics, with a great improvement in the effects.

Of the preparations of digitalis, the infusion of the leaves is undoubtedly the best in heart dilatation, in doses of 1 to 2 drachms every three or four hours. A reliable tincture comes next in value, in doses of 10 drops, but the fluid extract is the least certain in its effects—in heart affections, at any rate. The nitro-glycerin should be administered only in a recently-made solution, $\frac{1}{4}$ grain to 3 ounces of water, a tea-spoonful of which contains $\frac{1}{96}$ of a grain. The small manufactured nitro-glycerin pills supplied to druggists are often untrustworthy. The dose should be that which shortly after administration gives a slight sense of fulness in the temples. The difference in susceptibility among patients to this drug is remarkable, some being able to take $\frac{1}{25}$ grain without feeling it, while others complain of headache from $\frac{1}{200}$ grain.

Along with digitalis, strychnine or the tincture of nux vomica is another excellent adjuvant. I prefer the tincture, and give it in 10-drop doses with the digitalis and the nitro-glycerin. The administration of these three drugs can be kept up without change for an indefinite period with some patients, just as some asthmatics can take their favorite prescriptions for months, but with most patients digitalis after a time disturbs the stomach, and we are obliged to intermit its use.

The tincture of strophanthus, in doses of from 5 to 10 drops, is, according to my experience, a good substitute for digitalis, and I often prescribe it along with digitalis itself, as well as with the other neurotics mentioned. It is particularly adapted to all cases of palpitation, whether functional as in Graves' disease or when complicating organic affections. It does not equal digitalis in the treatment of dilatation, for it does not interfere with the diastole, but it is almost free from

the contracting effect of digitalis on the arterioles. One drawback is the uncertainty of its preparations, which sometimes vary greatly in their properties. Some two years ago the tinctures supplied to the New York market were noted for causing diarrhœa.

A very valuable heart-stimulant also is caffeine, in doses of from 1 to 4 grains of the citrate. It seems specially adapted for the dyspnœa of mitral stenosis, and, with nux vomica, is better than digitalis in aortic incompetence.

My experience with convallaria majalis, sparteine, and barium chloride has been tolerably extensive experimentally, but with such uncertain results that I can rank them only with those remedies which may be tried haphazard when one does not know what else to give, for, like all other neurotics except colchicum, they cannot do any permanent mischief.

In many cases of beginning arterio-sclerosis, with high-tension pulse, we have a serious symptom of developing mischief in a quickening of the pulse. These patients naturally complain of head-symptoms, and may come for the first time for advice on account of such troubles as vertigo, etc. The rapid pulse implies subacute endocarditis, and then aconite, with small doses of corrosive sublimate, $\frac{1}{30}$—$\frac{1}{24}$ of a grain, should be administered, with the constitutional treatment to be soon mentioned.

In contrast with this symptomatic treatment of chronic diseases of the heart the physician should study how their structural changes can be prevented or averted. This can be done only by reversing their processes of development according to the physiological laws which their development shows to have been contravened. Thus, the heart as a muscular organ depends for its vigor, as all muscles do, on the activity of the respiration. It is a universal law throughout the animal kingdom that muscular power is directly proportioned to the amount of oxygen consumed. This is why insects, who can breathe from nearly every part of their bodies, are so exceptional in muscular strength. The recent discovery that muscles have in addition to, and independent of, their contractile function, the function of generating animal heat is one of great significance in establishing the prime necessity of the oxygen-supply to them. The blood coming from a large muscle, such as the gluteus when at perfect rest, is nevertheless more venous in its diminished oxygen and increased carbonic acid than the blood of the right ventricle, because the latter contains visceral venous blood also, and glands, even when most active, do not abstract as much oxygen from the blood as muscles do when apparently most inactive. The application of these principles to a case of threatened weakening of the heart-walls is obvious. Such a patient demands the freest respiration which can be secured for him, and which will be in as complete

contrast with his bodily habits in the past as possible. It is from that point of view alone that I regard Oertel's treatment of heart diseases as capable of doing good. The other features of the system, of enjoining active muscular exercise, such as mountain-climbing, etc., are applicable only to a minority of cases, and require the greatest discrimination in their employment, for the ratio between allowable work and overwork varies so much in different cases that I prefer safer methods for attaining the same results.

An ideal environment for a patient with organic heart disease would be a comfortably furnished shed-shaped tent, with good ventilators at each end and with a board floor well raised from the ground. Tents with all the requisite facilities for camping can be obtained in this country now, and with a little experience a camp-life can be made more comfortable, enjoyable, and less expensive than living at any Adirondack hotel, with the great object secured of really constant free breathing; for no dwelling apartment can give the same air at night which the patient receives through the tent-walls, as it is continuously changed through them without a draught. The most noticeable effect of two or three months of camp-life is in the lowered arterial tension, which may be noted even in the worst cases of arterio-sclerosis. The restoration of visceral muscular power is also illustrated in many other ways. I have known obstinate constipation of years' standing thus spontaneously relieved, the residual urine in elderly patients with distended bladders greatly reduced (in one case a man of seventy-four was quite cured), and chronic bronchitis progressively improve, with no other agency to account for these results than simple free breathing, with but very moderate muscular exercise. When camping cannot be resorted to, the next most continuous mode of open-air life must be devised, and the patient be enjoined to spend as little time indoors as possible, the details for securing this end being those which circumstances will permit.

It is on this principle that iron is the medicine for organic heart disease, not only as a standard remedy, but as a prophylactic against muscular degeneration. Iron has only one object in the animal economy. Without it we could not breathe. To keep up the due proportion of this oxygen-carrier in the blood is therefore the great indication whenever a form of muscular weakness is likely to develop, whether in the bronchial tubes, the alimentary canal, the pelvic organs, or, lastly, in the circulatory system. Every case of organic heart disease or vascular disease therefore indicates the use of iron, if only to keep hypertrophied muscles from losing their contractile power. The prompt improvement caused by iron in such a variety of disorders of weakened tubular organs is not because it cures "anæmia," but because it revivifies their muscular walls with an increased supply of oxygen.

In primary chronic valvular disease open-air life and iron, taken from time to time as a prophylactic, will serve indefinitely to ward off the day of heart failure. With the rheumatic cases, however, we must be on the constant watch for relapses of the rheumatism, and consequent further heart mischief. As the left ventricle often hypertrophies rapidly in young persons with aortic lesions, while the right does not, pains in the cardiac region and palpitation are prone to develop from derangement of rhythm between the two sides. For this belladonna is the best sedative, in 10-drop doses of the tincture, with 4 or 5 grains of potassium iodide three times a day, and the patient should wear a belladonna plaster. Cod-liver oil is of great service in many cases also. Its first use in medicine, to which it was restricted for over a century, was in the treatment of rheumatism, and for the anæmia of protracted cases of the subacute articular form it is superior to any other remedy. During cool or winter weather these patients should wear as a preventive buckskin shirts over light flannel underwear, and they should sleep in flannel. It is always risky for rheumatics to indulge in cold-water bathing, but the ancient practice of daily skin inunctions is one of the best of prescriptions for them against fresh attacks.

In chronic secondary valvular disease we have to take into account the constitutional state which has caused the heart affection. In the high-tension pulse of gouty and lithæmic patients a steady course of lithia-water is to be prescribed. The Buffalo lithia-water is rather too weak in lithia, but I have known a year's course of it improve the short breath of some patients very strikingly. The Londonderry Spring of New Hampshire has the highest percentage of this salt of any spring in this country, and five to six goblets of it a day, taken in lieu of ordinary water, may be prescribed. In many cases the French Contrexeville Pavilion Spring water, a goblet with each meal and at night, has been beneficial, especially where the gouty symptoms were pronounced.

The heart complications of Bright's disease have to be treated in connection with the kidney affection. Where the urine is pale and of low specific gravity, with a moderate deposit of albumin, corrosive sublimate, taken for a week at a time, $\frac{1}{24}$ of a grain three times daily, and then omitted for a week, has, in my experience, repeatedly improved the color and specific gravity of the urine, and has lowered the arterial tension. The important adjuvant action of nitro-glycerin has been already alluded to. It is in these patients also that the beneficial effects of frequent warm, but not hot, baths in relaxing arterial tension is manifested.

In the renal cases, of whatever form, the importance of regulating the diet cannot be over-estimated. In view of the recent advance in

our knowledge of the relations of intestinal digestion, and the rôle which auto-infection from intestinal poisons plays in the genesis of vascular and kidney disorders, the indications for supplying the most easily assimilable food, with the least excess possible of too concentrated nitrogenous ingredients, in kidney disorders, are more than ever confirmed.

No case of high-tension pulse, with consecutive heart complication, should take a hearty meat diet. The best food for such patients is the fermented milk of the Arabs. All pastoral peoples, who have to live exclusively on milk, as most Bedouins and Tartars do, have found that the stomach must be spared the curdling of the milk, else enough gastric juice is not left to complete the digestion of the precipitated casein; which, moreover, if precipitated in the stomach, is apt to be in too large and solid curds. They therefore artificially ferment the milk with the yeast-plant. The Arab method is preferable for invalids to the kumyss of the Tartars, as this is apt to be too acid from keeping. The "leben" of the Arabs or "matzoon" of the Turks is made daily by adding some of the fermented milk of the previous day to the fresh milk as soon as it is brought in from the milking. The "leben" the next morning is a slightly acid fluid of the consistence of cream, with small flaky curds and with the taste of buttermilk. I regard it as the completest and most digestible food for invalids that can be furnished, and the most striking illustration of its adaptability is to be found in severe organic diseases of the stomach with intractable vomiting, as in gastric ulcers or cancer of the stomach. In Bright's disease it has seemed to me often curative, and at least as near the typical food for giving the diseased kidneys the minimum of work as can be devised. The more the patients take of it to the exclusion of other food, the better, and to accustom them to its use they may begin with a half pint taken as a first course with each meal. It should always be *eaten* with a spoon like soup, and not drank. After a time larger and larger quantities will be readily disposed of. The directions for making it are: to break up by thorough stirring half an ordinary yeast-cake in half a pint of good fresh milk which has been warmed to a blood heat. This should then be kept for eight to ten hours in the kitchen, with occasional stirring, at the end of which time the milk will be found to have soured. Six tablespoonfuls, or 3 ounces, of this soured milk should then be stirred into a half pint of fresh milk, and the first half pint with the yeast thrown away. The second specimen will ferment in the same time as the first one did, but cannot yet be eaten on account of the still perceptible bitter taste of yeast; but 3 ounces of it can be used for a third specimen. In the fourth specimen the taste of yeast is no longer perceptible, and then the leben can always be made for each day's use in the proportion

of 6 ounces of the leben of the previous day to a pint of new milk. It is better to stir it well as soon as the milk is found to be changed, and then put in a refrigerator to prevent further acidification. Sometimes, after a month or two months, the yeast ferment seems to die out, and the process has to be begun again as above detailed. If it seems to make too large curds, it need then only be stirred well before eating it. The richer the milk in cream, the better and smoother the leben. With this milk and a digestible vegetable diet (excluding beans, asparagus, and fibrous vegetables, as turnips, beets, etc.), and a good supply of ripe fruit, especially grapes, the tension of the pulse may be found soon much less than when meat and fermented liquors have been largely used.

The management of certain acute complications remains now to be briefly spoken of. In all cases of labored heart-action a daily evacuation of the bowels is very necessary, for constipation quickly raises the tension of the abdominal arteries, and thus increases the heart's work. One tea-spoonful of Epsom salts, with a grain of quinine, in a tumbler of water on rising, may be prescribed as in most cases a sufficient laxative. In others a tea-spoonful of the compound liquorice powder, with a tea-spoonful of cream of tartar at night, while in still others one-fourth or half a tumbler of Hunyadi water in the same amount of boiling water in the morning, is best. All highly carbonated waters are ill borne by patients with heart disease, and the hot water is a good addition to prevent or get rid of the flatus which remains after most mineral-water purgatives have acted.

In advanced cases of heart disease we are often obliged to have recourse to opium to secure sleep. The rhythm of lung- and heart-action needed for sleep will not come without it. It is a hard alternative to meet, for the ultimate effect of the drug is undesirable, and its administration should be postponed until it is plain that the patient will be more weakened by his sleeplessness without it than by his depression with it. Any other soporific is useless, particularly chloral, but the aromatic spirit of ammonia may be very advantageously added to morphine when the alkaloid is given.

The attacks of asthmatic suffocative congestion of the lungs in renal disease with cardiac dilatation require prompt and active treatment. The aim should be to rouse the weakened left ventricle to action, and for this purpose a hypodermic injection of $\frac{1}{3}$ grain of morphine with $\frac{1}{120}$ grain of atropine should be given, and simultaneously by the mouth a tea-spoonful of aromatic spirit of ammonia with 3 tea-spoonfuls of the elixir of valerianate of ammonia in water. Dry cupping over the kidneys and back of the lungs should then follow, with the application of a large blister to the front of the chest, which should be allowed to stay on long enough to redden the skin, but not to pro-

duce vesication. As soon as the dyspnœa and the expectoration show symptoms of subsiding, a brisk cathartic of 40 to 60 grains of compound jalap-powder, with 5 grains of calomel, should be given, or 1 to 2 drops of castor oil. Fränzel recommends 1 grain of acetate of lead to be given every hour while the urgent symptoms continue.

In the ascites of dilated heart from extra-pericardial adhesions I have seen more good follow tapping than in abdominal dropsy from any other cause. The severe distress of the patient is often remarkably relieved, for it would seem as if abdominal distension produced a special strain in these patients on the adhesions to the ribs and to the lower sternum. One measure, however, should never be neglected in these patients, and that is to strap firmly the ribs of the left side with adhesive plaster up to the axillary line. The strips should extend from the spine to the median line, following the direction of the ribs, and in applying them pressure should be made along the lower, and not the upper, border of the strip, to have it fit evenly, each succeeding strip also overlapping half the width of the one previously applied. The great relief which this uniform restriction of the movements of respiration over the heart affords is immediately appreciated by the sufferer. From time to time the strips have to be left off on account of irritation of the skin caused by the plaster, and during the interval the whole præcordium should be rubbed with an ointment composed of unguentum stramonii, unguentum hydrargyri, of each ʒij, oleum cinnamomi gtt. ij, in hopes of assisting in the absorption of the adhesions.

NERVOUS DISEASES OF THE HEART.

By T. LAUDER BRUNTON, M. D., D.SC. EDIN., LL.D. (HON.) ABERD., F. R. S.

THE nervous diseases of the heart may be divided into two classes, according as they affect the sensory or motor apparatus of the organ. These two classes are not altogether distinct, both the sensory and motor apparatus being sometimes affected together, but for the purpose of classification they can be distinguished from each other in a fairly satisfactory manner.

The motor affections may alter the strength or rate of the heart-beats, or both. Those which are usually recognized as nervous are palpitation in which the apparent strength of the beat is increased while the pulse-rate is unchanged, excessive rapidity of the pulse, or tachycardia, excessive slowness, or bradycardia, and irregularity of the pulse. The irregularity may affect either the number or strength of the pulse-beats, or both, and the form in which one beat is dropped in an otherwise regular pulse is designated as simple intermittence. These abnormal conditions may occur without its being possible to show that any organic disease is present, and they are then more particularly to be regarded as nervous.

The sensory affections of the heart occur in the form of uneasiness, oppression, or pain, and may vary from slight discomfort in the cardiac region to the intense agony of severe angina pectoris.

PHYSIOLOGY OF THE CIRCULATORY APPARATUS.

Before entering upon a discussion of the diseases of the heart, it may be advisable to give a short account of the physiology of the cardiac nervous system. This is extremely complicated, and a good deal of difference of opinion exists in regard to it. A description of it at this time must, therefore, not be regarded as absolutely true in all respects. All that can be done at present is to give such an account of it as will best correspond with the knowledge we possess, but it must be borne in mind that new discoveries may not only extend our knowledge, but may lead us to modify considerably the opinions we now hold. The nervous system of the heart and its relationships with other parts of the body are so complex that I may perhaps be

excused for trying to simplify their apprehension by employing a very homely illustration, and comparing the heart with its nervous system to a horse and its driver.

Cardiac Muscle.—It is now generally held by physiologists that the muscular fibre of the heart, like other muscles, both voluntary and involuntary, possesses in itself the power not only of contraction, but of *rhythmical contraction* apart from any nerves or ganglia. Such rhythmical contraction, however, of involuntary muscular fibre is usually displayed only when the muscle is subjected to a certain amount of stimulation. The muscular fibres are less sensitive to stimuli than the nervous, and consequently a smaller amount of stimulation will produce rhythmical contraction, if it can act upon the muscle through the nerves or ganglia, than if it acts upon the muscular fibre directly. The heart may thus be compared to a cart-horse which would stand still if no stimulus whatever were applied to it, but which would walk on rhythmically if stimulated by the prospect of a feed of corn when it reached its stable. It would do this even if blindfolded, but if its eyes were open the sight of the corn, acting through the nervous system, would stimulate it more readily.

Cardiac Ganglia.—But while the heart contains in itself the elements of rhythmical contraction, partly in its muscular fibre, and probably also in part in its intrinsic nerves and ganglia, so that it will beat for a considerable length of time after removal from the body, its movements while *in sitû* are regulated by the central nervous system.

Medullary Centres.—The chief centre by which the circulation is controlled and the beats of the heart are regulated both in strength and frequency, so as to suit the resistance which the organ has to overcome in driving the blood through different parts of the body, is situated in the medulla oblongata. In this part of the nervous system, closely related to one another, we have centres for the heart, for the blood-vessels, and for the respiration, so that the pulse, the blood-pressure, and the breathing may all be kept in harmony with one another. The centres here may be compared to the driver of the cart, who makes his horse move slowly by pulling the reins or quickly by using the whip, and increases or lessens the resistance to be overcome by putting on or taking off the brake when the vehicle is going down or up hill. The reins by which the heart is restrained or inhibited are certain fibres contained in the vagus nerves, the whip is contained in the sympathetic nerves, and the drag is the vaso-motor centre which contracts or relaxes the vessels so that the blood flows through them with greater or less difficulty, and thus a greater or less resistance is presented to the ventricular contractions.

Inhibitory Fibres.—The restraining or inhibitory nerves of the

heart, although contained in the vagus trunk, are really derived from the spinal accessory, while the other nerve-fibres contained in the vagus are probably sensory. The origin of the inhibitory fibres is shown by the fact that when the roots of the spinal accessory have been torn out, and the fibres proceeding from them to the heart have consequently degenerated in accordance with Waller's law, irritation of the vagus trunk ceases to have the power of slowing or stopping the heart which it would have in a healthy animal.

Inhibitory Apparatus in the Heart.[1]—The mode of termination of the inhibitory fibres in the heart has not been made out with certainty, but experiments upon the actions of certain poisons lead to the conclusion that just as the reins are rarely fixed directly to the horse's head, but end in a bit by which their action is increased, so the inhibitory vagus fibres end in some apparatus within the heart and act through them. This conclusion is, to a great extent, founded upon observations made on the heart of the frog. This may not be quite applicable to mammals, but in the absence of more definite information we are at present almost obliged to regard the nervous system of the mammalian heart as analogous to that of the frog. The experiments upon which our observation is founded show that if the vagus trunk be irritated by an interrupted current, the heart-beats are rendered slow, but if nicotine be injected in sufficient quantity, no irritation of the vagus will slow the heart, any more than the driver can stop his horse if his reins have been cut. But if the venous sinus of the frog's heart be stimulated after the vagus trunk has been paralyzed by nicotine, the stimulation will stop the heart, just as the driver might stop his horse by seizing the bit even after the reins were cut. If instead of nicotine we use atropine, neither stimulation of the vagus trunk nor stimulation of the venous sinus will stop the heart, any more than the driver can stop his horse if, instead of the reins being cut, the bit has fallen out of the horse's mouth.

Anabolic and Katabolic Actions.—The inhibitory vagus fibres, while slowing the heart, tend also to maintain or even restore its power, and, while lessening its action for the time being, will prolong the time during which it retains its irritability, in the same way as the judicious use of the rein, rather than of the whip and spur, has enabled men in a race for life across the prairies to reach their destination in safety, while others, who distanced them at the outset, have exhausted their horses and perished. Thus, if three animals be taken, all as nearly alike as possible, and the vagus nerves be cut in one, so that the heart beats much more quickly than normal, while in another they are stimulated, so that the heart beats more slowly for some time, and

[1] This view is not held by some physiologists, but it enables us to explain certain phenomena, and especially the action of poisons, more easily than any other view.

the animals be then all killed and the hearts excised, it will be found that the heart which beat more quickly than the normal perishes the soonest, while that which went slower than the normal outlives the heart of the animal which had not been experimented upon.

The power of the vagus to lessen waste and lead to the storing up of nutriment in the heart has been called by Gaskell anabolic, while its opposite effect—namely, the rapid action, and consequently quick using up of the nutritive material coincident with quick action of the heart, such as is produced by section of the vagus or still more by the accelerating nerves of the heart—has been termed catabolic.

Tonic Action of the Vagus.—In healthy men the inhibitory part of the vagus is always more or less in a state of tonic action, just as the driver gently feels the mouth of his horse and keeps it in hand. The extent to which the vagus restrains the beats of the heart in man has been approximately ascertained by the pulse-rate in cases of poisoning by belladonna or atropine, for in such cases the vagus is completely paralyzed by the poison, and the power of the inhibitory centre in the medulla over the heart is as completely destroyed as if the vagi had been cut across. In such cases the pulse-rate usually varies from 120 to 180. Most commonly it is between 140 and 150.[1] But belladonna and atropine not only destroy the power of the vagus; they stimulate to a certain extent the accelerating nerves of the heart also, for if small doses of atropine be injected into the circulation after the vagi have been divided, the beats of the heart are still further quickened.[2] We may perhaps not be far from the truth if we estimate the acceleration due to the stimulating effect of atropine as equal to ten, fifteen, or perhaps twenty beats per minute, so that we might not be far wrong in assuming that simple removal of the vagus tone would allow the pulse to beat at the rate of 125 to 135, instead of 65 to 75. At the bedside we meet so frequently with a pulse-rate of 120 that one is almost inclined to think that this may be a common pulse-rate when the vagus is inactive.

Accelerating Nerves of the Heart.—The accelerating nerves of the heart, which stimulate it to more rapid and forcible action, are chiefly contained in the sympathetic. The position of the accelerating centre has not been definitely localized. It may, like the inhibitory, be chiefly situated in the medulla oblongata, but acceleration can no doubt be produced by centres lying higher up in the cerebrum. The accelerating fibres pass down in the cervical cord and out by the rami communicantes to join the cardiac plexus. We do not know the exact

[1] *Ueber die Physiologischen Wirkungen des schwefelsauren Atropins*, von A. V. Bezold and Dr. Friedr. Bloebaum, p. 56.

[2] Lemattre, *Archives générales*, August, 1885; *Therapeutics*, by H. C. Wood, 7th ed., p. 296.

nerves through which they pass in man, but in the dog they leave the spinal cord in the anterior roots of the second and third, perhaps also the fourth and fifth, dorsal nerves. They pass in the rami communicantes in these nerves to the ganglion stellatum and first thoracic ganglion. Thence some fibres appear to go upward in the loop of Vieussens to the anterior cervical ganglion, and thence to the heart. Their course, however, is so complicated and varied that it is hard to give any exact account of it.[1]

Sensory Nerves of the Heart.—The vagus and accelerating nerves belong to the efferent class, and convey impulses outward from the centre in the medulla to the heart. They may, as I said, be likened to the reins and whip of the driver of a wagon. But the reins not only convey to the horse the wishes of the driver; they also convey to the driver the intentions of the horse; and in this respect the vagus and the reins resemble each other. For the vagus nerve not only contains efferent inhibitory fibres; it also contains sensory fibres, which convey impressions from the heart to the medulla, and not only produces reflexly such alterations in the contraction of the arteries and in the respiratory movements as will suit them to the needs of the heart, but may even produce pain more or less severe, and thus bring to a stop movements of the limbs or of the body generally when such movements are tending to put upon the heart a strain greater than it can well bear.

Work of the Heart.—But we must now turn from the heart itself to the work which it has to do. This consists in driving the blood into an elongated, branching, elastic tube, the aorta and arteries. This branching tube may be regarded as opening at one end through the capillaries into a nearly empty vessel, the veins. For the venous system is able to contain the whole of the blood in the body, and indeed does so after death, while during life it is so imperfectly filled as to present almost no obstacle to the flow of blood into it from the arteries.

Contraction of Capillaries and Arterioles.—The resistance which the heart has to overcome is therefore almost entirely determined by the difficulty with which the blood can flow out through the capillaries, and this again chiefly depends upon the greater or less amount of contraction which occurs in these vessels and in the arterioles with which they are immediately connected. When these are much contracted the blood flows out with difficulty, the tension in the arterial system rises, and the work which the heart has to overcome at each beat is increased. On the other hand, when the arterioles and capillaries are dilated, the blood readily flows through them into the veins, the pressure in the

[1] For a number of experiments on this subject see Schmiedeberg, *Ludwig's Arbeiten*, sechste Jahresgang, 1871, p. 34.

arterial system sinks, and the resistance which the heart has to overcome is proportionately diminished.

But, as a rule, the arterioles are not equally contracted or dilated at the same time, for their calibre depends upon the need which the part of the body to which they are distributed has for more or less blood. The whole vascular system has been well compared by Ludwig to the water-supply of a large town, such as London, where, the quantity of water being insufficient to supply the whole town at once, the turn-cocks go about cutting off the supply from one district while they turn it on to another. As a rule, then, we find that when the vessels at one part are contracted, those of another are dilated, and *vice versâ*.

Vascular Districts.—There are three great vascular districts in the general circulation which have to be considered—viz. (1) the skin; (2) the abdominal viscera; and (3) the muscles. The vessels of the skin and the viscera are controlled by the vaso-motor centre in the medulla oblongata, and when this centre is excited the vessels both of the skin and of the intestine contract. As a rule, however, when the vessels of the skin are made to contract by the application of cold, and not by stimulation of the vaso-motor centre, the blood, being driven from the skin, passes into the internal organs and abdominal viscera. To some extent, at least, the vessels of the third district—namely, the muscles—are much less under the control of the vaso-motor centre than the other two, unless, indeed, such an arrangement exists in this centre that it actually causes them to dilate at the time when the others contract. It is obvious that if the heart stands still, the blood will continue to pour out from the arterial system into the veins, and that the pressure in the arteries will consequently diminish steadily. One would suppose that irritation of the vaso-motor centre under such conditions would, by contracting the arterioles throughout the body, prevent the escape of blood into the veins, and thus stop the fall of pressure in the arteries. But this is not the case, for Ludwig and Hafiz found that when the heart was made to stand still and the vaso-motor centre was irritated, the blood seemed to pour out through the vessels of the muscles in such quantity that the pressure sank nearly as quickly as when the vaso-motor centre was not interfered with. This curious independence of the muscular vessels is probably of great importance physiologically, and must, I think, be borne very carefully in mind in considering the pathology of shock and syncope.

The calibre of the vessels in the muscles is regulated to a considerable extent by the vaso-motor nerves contained in the motor nerves of the muscles themselves, but their permeability to the flow of blood is also modified to a great extent by the mechanical pressure exerted upon them by the fibres of the muscle during its contraction. We would

naturally suppose that the contracting muscle would require a greater amount of blood than usual in order to supply it with oxygen and nutriment, as well as to remove the waste products generated by its activity, and consequently would look for dilatation of its arteries. And, indeed, this is what we find, for stimulation of the motor nerve of a muscle not only causes its fibres to contract, but causes its blood-vessels to dilate, and the amount of blood which passes through to be consequently increased. This increase, however, is most marked after the contraction is over, for during the contraction itself the pressure of the muscular fibres on the arteries may be so great as to interfere very considerably with the passage of blood through them. The resistance thus opposed to the flow of blood from the arteries into the veins may be so great when many muscles are called into action that the general arterial pressure rises very considerably; indeed, as a rule, a violent struggle in an animal will raise the pressure within its vessels enormously. As the flow of blood through the muscle depends upon these two opposing factors, and perhaps still others not yet fully understood, the amount which passes through the muscular vessels during exertion varies very considerably; and while powerful contractions may sometimes arrest the flow entirely, gentle contraction may increase it considerably above the normal. Thus, while severe exertion may cause a great rise of blood-pressure, gentle or moderate exercise may distinctly lower it. To this point we shall have occasion to refer when discussing the pathology of angina pectoris.

We really know very little about the flow of blood through the muscles in man, although many experiments have been made by Ludwig and his scholars on the lower animals. We may assume that in its main points the regulation of the circulation in muscles is the same in man and in animals; but in man we have to remember that the cerebrum is much more developed than in the lower animals, and that mental affections and emotions may have, and probably do have, a very much greater effect upon the circulation than they do in the lower animals. Although the circulation is certainly very greatly affected by emotion, even in the lower animals, yet we very rarely, if ever, find fainting as a consequence of emotion in them, whereas it is not uncommon in the human subject. During fainting the face becomes blanched and the whole surface of the body pallid. It is usually supposed that this is due to blood having left the surface and gone into the internal organs, but an observation of John Hunter's seems to show that the blood, in fainting, is really coursing with unusual rapidity through the muscles, and that the large area opened to the passage of arterial blood by dilatation of the arteries supplying the muscles leaves the ordinary channels through the surface empty. Hunter observed, while bleeding a lady who fainted, that while the faint

lasted the blood which flowed from the vein, instead of being dark and venous, was of a bright scarlet, like that of arterial blood.[1] From the observations of Claud Bernard on the submaxillary gland we know that the arterial color of the blood in a vein is associated with dilatation of the capillaries, so that the blood streams so quickly into the vein that time is not allowed for it to assume its usual venous condition. Hunter's observation seems to show that while the skin of the arm was blanched, the capillaries of the muscles were so much dilated, the blood simply pouring through them, that at the bend of the elbow it was arterial in character. This contraction and relaxation of the vessels which supply voluntary muscles independently of those going to the skin or to the intestines is, I think, a factor of much importance in regard to the circulation, and one which has hitherto received too little attention, for Ludwig's observation seemed to show that in a given time as much blood may pass through the muscles as would flow through both the skin and intestines together. We can thus see what an enormous effect any change in the circulation through the muscles may have upon the pressure in the arterial system generally, and consequently what a tremendous influence muscular exertion will have upon the heart, especially when the heart is weakened by disease.

It is obvious that the ranges within which the blood-pressure might vary are so great that they would be destructive to the life of the animal were it not that one factor usually counteracts another, and keeps the pressure more or less constant. As a rule, whenever the pressure rises in the arterial system, its increase acts as a stimulus to the inhibitory roots of the vagus, and thus slows the pulse. Less blood is thus sent into the aorta, and the tension within it is brought to the normal and kept there. On the other hand, when the arterial pressure falls the ordinary stimulus to the vagus roots is diminished, the heart acts more quickly, and the tension in the aorta is thus again brought up to the normal. Besides this, whenever the tension becomes so great as to inconvenience the heart, the sensory nerves of this organ bring into action reflexly a mechanism for dilating the vessels. In the rabbit these sensory fibres pass upward from the heart as a distinct nerve, the depressor nerve, and when stimulated they cause great dilatation of the vessels in the abdominal viscera, so that the blood-pressure falls at once.

The exact situation of these nerves in man has not been ascertained, but in all probability a similar mechanism exists. The pulse-rate in health thus depends to a great extent on the pressure within the vessels. In disordered conditions of the nervous system it may vary to a great extent independently of this.

[1] *Works of John Hunter*, edited by Palmer, 1837, vol. iii. p. 91.

Motor Nervous Diseases.

Functional Palpitation.—In healthy conditions of the internal organs one ought to be completely unconscious of their existence, but in functional palpitation the patient becomes unpleasantly aware of his heart by feeling it throbbing. This throbbing may be confined to the heart itself or may be felt also in the vessels. In some cases the sensation which the patient feels is not accompanied by any change in the pulse or heart-beat sufficiently great to be perceptible to others, and the apex beat and pulse appear quite normal, although it is possible that the application of finer instruments of research might show that some change had actually occurred. In other cases, palpitation can not only be felt by the patient himself, but can readily be recognized by others, for the impulse of the heart's action against the ribs is forcible and hammering, and the pulse is frequently quickened, although in some cases the pulse may even be slower than usual. In regard to the conditions which actually are present in palpitation from mental emotion, the experiments of Couty and Charpentier, which are mentioned further on (p. 752), are very interesting, and in discussing the palpitation produced by digitalis I found that the cardiac contractions are actually increased in strength during the continuance of palpitation produced by this drug.[1]

The most common cause of palpitation is mental emotion of some kind, such as fright, joy, sorrow, expectation, and anxiety. These emotions will excite palpitation even in perfectly healthy, strong people, but they do so still more markedly in persons of a nervous temperament and feeble physique. Generally, women are much more liable to palpitation than men. In both women and men the tendency to palpitation becomes much greater when they are weakened by debilitated conditions, either mental or physical, such as anxiety, continued sleeplessness, over-work, over-excitement, hysteria, sexual excess, anæmia, chlorosis, and prolonged lactation.

Irritation of the vagus and vaso-motor nerves, whether central or peripheral, may also lead to palpitation, and it may therefore occur from hæmorrhage or tumor in the brain or spinal cord or in the course of the vagus or sympathetic tracts. Reflex irritation of the cardiac nerves, especially from the stomach, is a frequent cause of palpitation. It may occur from some distension of the stomach by flatus or by the presence of indigestible or irritating articles of food. In a case of distension of the stomach by wind a mechanical condition of the heart probably co-operates with the nervous cause of palpitation, for the stomach is separated from the heart only by the diaphragm, and when the stomach is distended it tends to lift the heart out of its

[1] *On Digitalis*, London, Churchill, 1868, p. 28.

normal position and tilt the apex more upward. A similar result may follow distension by a too abundant meal, as the effect of distension of the stomach would be nearly the same whether it were caused by gas or by solid or liquid food. Some cases of sudden death appear to be due to such distension. It is known to occur in animals that have fed upon damp clover, and one of the ancient methods of poisoning was to make the person swallow a large quantity of freshly-drawn bull's blood. This, by forming a large solid coagulum in the stomach, would keep it permanently distended, and thus kill the person to whom it was administered. A case of sudden death which occurred a year or two ago in a man who had taken a large meal of potatoes and milk was probably due to the same condition.

Reflex palpitation may occur from irritation of the abdominal nerves, such as those of the intestine by scybalous masses in cases of constipation or by worms, irritation of the gall-duct by the passage through it of biliary grit or small calculi, by irritation of the kidney in renal colic, or, still more frequently, by the dragging of the renal nerves in cases of floating kidney. Irritation of the uterus and ovaries, either by congestive or inflammatory conditions or by malposition, such as prolapse, are a still more common cause of palpitation. One cause of palpitation which may be looked upon as partly direct and partly reflex is diminished blood-pressure, which may be caused by several conditions. When it occurs through dilatation of the arterioles, the heart, having little opposition to overcome, works, as I have said in a former paper, "fast and loose, like the driving wheel of a locomotive

FIG. 44.

Tracing of the pulse of a healthy young man in whom the vessels have been dilated and the heart consequently quickened by the inhalation of nitrite of amyl.

on a piece of greasy rail."[1] Palpitation may be occasioned in this way by exposure to undue heat, as in a Turkish bath, warm bath, or even warm foot-bath, or by lessening the pressure in the abdomen by the removal of fluid in ascites.

In exophthalmic goitre palpitation of the heart is usually one of the most prominent symptoms. It is usually accompanied by exceedingly rapid action of the heart, though cases are recorded in which the pulse has been abnormally slow.

TOXIC PALPITATION.

It is possible that the palpitation occurring in constipation, gout, and indigestion may sometimes be due to the absorption of toxines

[1] *Practitioner*, 1876, vol. xv. p. 311.

from the intestinal canal. At any rate, we know certainly that some substances are very liable to produce palpitation. Tea is a marked example of this, and more especially green tea. Coffee produces it in some, but not so frequently as tea. Tobacco is also a cause of palpitation, leading to pseudo-angina, which will be discussed later on. Position may give rise to palpitation, and some people cannot lie on their left side on account of the palpitation which they feel in this posture. The cause of this is not quite clear, but possibly it may be due to the mechanical irritation which the heart experiences by beating against the ribs in this position.

Stimulation of the skin over the cardiac region may occasionally give rise to palpitation, and I have seen one case in which it was brought on to such an extent by the application of ammonia over the left breast in a man that the treatment had to be discontinued.

Treatment of Palpitation.—In most cases of palpitation the person involuntarily presses his or her hand over the heart, and the warmth and pressure usually give relief. In persons who are liable to palpitation a substitute for the continued application of the hand may be found in the application of a plaster to the cardiac region. Any plaster that is warm and that sticks firmly will answer the purpose, but belladonna plasters are usually preferred, as they seem to have a more sedative action than others. In applying the plaster it is well to make some cuts in its edge, so as to allow it to adapt itself more accurately to the chest, and in females cuts may be made to allow the plaster to be applied close under the breast.

Some alcoholic stimulation, such as ½ an ounce of brandy, either pure or with its own bulk of water, will frequently stop an attack of palpitation, but in cases in which the attacks are frequent it is inadvisable to have recourse to alcohol, on account of the risk of inducing a habit. In such cases 20 or 30 minims of aromatic spirit of ammonia may be given in water, and this may be made pleasanter, and perhaps even more effective, by the addition of 10 minims of spirit of chloroform and 20 or 30 minims of compound tincture of cardamom.

The action of the heart may be greatly quieted by the administration of small doses, such as 5 minims, of tincture of digitalis, with the same quantity of tincture of nux vomica, three or four times a day; and when anæmia is present, 5 to 20 grains of carbonate of iron in the form of pill, twice or three times a day, will be useful. The bowels should be kept regularly open, and if the motions be pale, small quantities of a mercurial purgative should be administered from time to time, followed by a saline laxative. Where the palpitation is due to mental excitement, bromide of potassium, in doses of from 10 to 20 grains, with saccharin to flavor it may be given either when the mental excitement is felt or at regular intervals at bedtime or dur-

ing the day. In cases of dyspepsia with irritability of the stomach bismuth and hydrocyanic acid will tend to lessen palpitation. Worms, if present, must be removed by vermicides, and if there be a floating kidney it should be supported by a pad, and any abnormal conditions of the genito-urinary organs must receive appropriate treatment.

Paroxysmal Heart-Hurry (Paroxysmal Tachycardia).

In some persons the pulse-rate is constantly high, although there is no fever whatever. In one lady that I knew the usual rate would be from 100 to 120, but she suffered from constant irritation in the rectum and sigmoid flexure and morning diarrhœa. This condition lasted for ten years. In other cases a persistently rapid pulse is associated with the presence of a floating kidney, although a floating kidney does not invariably give rise to this symptom.

In another class of cases the pulse is not persistently high, as in those that I have mentioned, but every now and again it is liable to sudden acceleration. To this condition the name of paroxysmal tachycardia has been given. These paroxysms may be—and indeed generally are—accompanied with palpitation, and are sometimes associated also with difficulty of breathing and pain in the cardiac region, like that of angina pectoris. The difficulty of breathing is sometimes so great as to make the attack resemble one of spasmodic asthma. Cases of tachycardia seem to me to be so much associated with nervous palpitation, with angina pectoris, and with asthma, that it is difficult to draw a distinct line between them.

The attacks last for a time varying from a few minutes to several hours, though they may continue for some days. The frequency of the attacks also varies within wide limits between hours, months, and years. There is also no limit to be placed to the length of time during which the patient is liable to these attacks.

Paroxysmal Slowness (Bradycardia).

In some people the pulse is naturally very slow, and in a fellow-student of my own the normal rate continued to be 42 per minute for years. The slowness may occur in consequence of irritation of the vagus roots by inflammation about the brain or medulla, by pressure from a tumor, abscess, or hæmorrhage, or from irritation by a venous condition of the blood, or by drugs, such as digitalis or tobacco. It appears also to occur in some people from the use of tea or coffee, although this is quite exceptional. It is not uncommon in cases of jaundice, and its occurrence here appears to be due, according to Wickham Legg, to the weakening action of biliary acids on the cardiac muscle.

Slowing of the heart through stimulation of the vagus may be produced reflexly by irritation of the stomach, intestines, or abdominal

organs in the same way as nervous palpitation. It may also be produced by the application of strong vapors, such as ammonia or chloroform, to the nose.

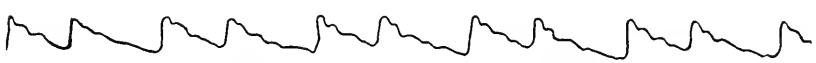
The prognosis, especially in elderly people, must be a guarded one, as the slow heart probably indicates a tendency to organic weakness.

The treatment is to relieve the condition as far as possible where it is due to irritation, and to stimulate the heart by ammonia, nux vomica, and small quantities of alcohol, and to maintain or increase the nutrition of the heart itself by good food, by iron where it can be borne, and by the elimination of waste material either by purgatives or diuretics.

Intermittent Pulse.

It is evident that if the cardiac diastole be prolonged at each beat to such an extent as to occupy the time usually allotted to two pulsations, the pulse will simply be very slow, but quite regular. If the

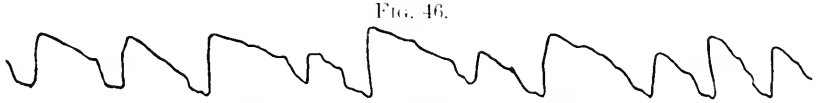
Fig. 45.



Bigeminal Pulse from Healthy Man in 1884.

diastole of each alternate pulsation be prolonged, we get the bigeminal pulse, consisting of two pulsations succeeded by a prolonged interval.

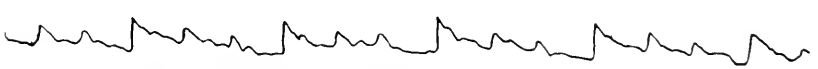
Fig. 46.



Bigeminal Pulse from same Man in 1891.

and if the diastole of every third pulsation be prolonged, we get a trigeminal pulse, and if the intermittence occur at longer intervals than

Fig. 47.



Trigeminal Pulse from Man suffering from Occasional Cardiac Pain

these, it is usual to speak of an intermission at every fifth or sixth beat, etc.

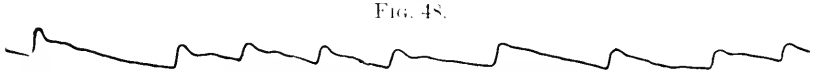
In some cases the intermissions are very regular, but in others they are irregular. Usually, the first beat after a long interval is fuller and stronger than the others. I have known a bigeminal pulse to last for many years in a gentleman of gouty diathesis, but strong and active, able and energetic, and in the enjoyment of complete health all the time.

But the bigeminal pulse, where the beats are also feeble and where the twin character has come on in the course of a severe illness, is of a much more serious character, and makes the prognosis much more grave.

Causation.—The excessive use of tobacco is a common cause of intermittence of the heart. According to my experience, there are two kinds of cardiac disturbance to which tobacco gives rise. The one is accompanied by palpitation and great irregularity of the heart, two or three slow beats being succeeded by four or five quick ones, and these again by two or three slow ones again. This form I have usually observed in workingmen who smoke a coarse kind of tobacco in pipes. The other form is one in which the pulse may seem quite regular when it is felt, but the person suddenly drops down unconscious, as if shot. This form is more common in people belonging to the upper classes, who smoke finer tobaccoes, and especially take them in the form of cigars or cigarettes. Once the tobacco heart has been brought on by excess, it may be kept up by the use of even a small quantity of tobacco, and in many cases the use of the drug must be entirely discontinued.

Intermittence of the pulse may come on from the same causes which lead to palpitation, paroxysmal hurry, or paroxysmal slowness, and in

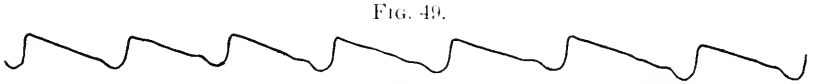
FIG. 48.



Tracing of the Pulse during Recovery from Poisoning by Digitalis, showing Abnormal Quickness alternating with Abnormal Slowness.

a case of poisoning by digitalis in 1865 I had an opportunity of watching these conditions appear during the process of recovery. When the

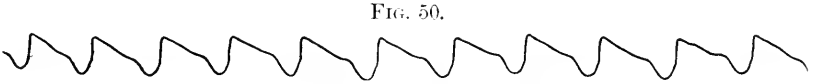
FIG. 49.



Tracing from the same Pulse later on, showing Abnormal Slowness.

patient was just recovering from collapse he had a very rapid beat of the heart, probably due to paralysis of the vagus. As he recovered

FIG. 50.



Normal Pulse in the same Case.

slow beats became interposed amongst the quick ones (Fig. 48); then the pulse became regular, but slow (Fig. 49), and finally returned to its normal (Fig. 50).

Prognosis.—Intermittence of the heart may last for many years.

and I have known one case of a lady who died suddenly at the age of eighty-four in whom it had lasted for sixty-seven years. It is especially common in people of gouty families. When it begins to make its appearance in gouty people advanced in years it may be usually looked upon as an indication that the strength of the heart and of the cardiac muscle is beginning to fail, and that measures should be taken to prevent every strain, either from emotion or exercise, to prevent overloading of the stomach, and to increase elimination.

ANGINA PECTORIS.

The great complexity of that part of the nervous system which regulates the movements of the heart and vessels and their relations to each other renders it very difficult to attain a definite knowledge of its diseases, either functional or organic. Consisting as it does both of afferent and efferent fibres, and of ganglia connected with them, it is evident that we may have, theoretically at least, disorders of these nerves which lead either to motor phenomena alone, to sensory phenomena alone, or to combinations of both motor and sensory disorders in varying proportions. It is probable that in most disturbances, whether functional or organic, of the cardio-vascular nervous system we have both motor and sensory derangement; but in some diseases the motor phenomena chiefly predominate, and in others the sensory, and this predominance may occur to such an extent that we are led almost entirely to fix our attention upon one class of symptoms and to neglect the other.

In angina pectoris there is probably in many, if not in all, cases a certain amount of excessive action in the muscular structures of the vessels or of the heart, or of both, yet the most important symptom, and that which almost entirely attracts the attention both of the sufferer and the physician, is the sensory symptom of severe pain. In the most typical cases of angina this pain is not merely severe, it is perfectly agonizing, and is accompanied with a distressing sense of impending death. But all attacks of angina, even in the same person, are not equally severe; at one time it may amount to extreme agony, and at another to little more than slight inconvenience or depression, hardly deserving the name of pain. On comparing the pain in different persons, also, we find the same irregularity, for while some suffer severely, others suffer very slightly, and, moreover, the pain not only varies in degree and duration in different persons, but varies in character and site.

The problem which we have to solve in trying to ascertain the path-

ological significance of these degrees of pain is very complex and difficult. In trying to do it we may be greatly assisted by the analogy between the heart and the bladder which Dr. Grainger Stewart alluded to in discussing Dr. Douglas Powell's paper. Both the heart and the bladder may be regarded as contractile bags, composed of voluntary and involuntary muscular fibres which contract and dilate at regular intervals. During their stage of dilatation or diastole they become filled with fluid, which flows into them from the veins in the case of the heart, and from the ureters in the case of the bladder. Their rhythmical movements of contraction and dilatation are regulated by the central nervous system, but when cut completely away from it they both continue to contract rhythmically of themselves, and to expel the fluid with which they are filled. In both cases they have to expel the fluid against a certain amount of resistance, which is offered, in the case of the heart, by the contraction of the circular muscular fibres in the walls of the arterioles and the friction of the blood in the vascular system, while in the case of the bladder the resistance is offered by the contraction of the circular band of muscle forming the sphincter vesicæ and the friction of the urine against the walls of the urethra. In the case both of the heart and of the bladder we have such a nervous arrangement as tends to prevent the contractile walls of the viscus and the opposing muscles of the arterioles or the sphincter from contracting simultaneously, at least to their full extent. This is the condition of health, not only in the heart and bladder, but also in other hollow viscera, such as the stomach and intestines. In all of them a certain amount of tone may exist in the fibres which oppose the exit of the contents of any one of these viscera during the contraction of its muscular walls; but when this contraction takes place to its utmost the resisting muscles in each case tend to relax and allow the contents of the viscus to escape. When the innervation of any one of these viscera is so dis-

FIG. 51.

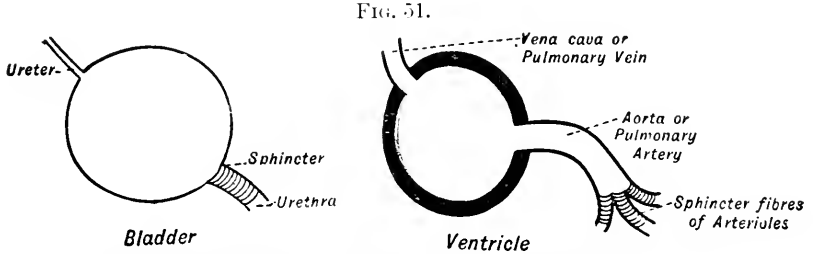


Diagram to Illustrate the Comparison between the Bladder and the Heart.

turbed that its walls contract, and the opposing muscles, instead of relaxing as they ought to do, also contract, we get pain as the result. In the stomach we get distension by gas, or painful retching instead of

the vomiting which might give relief. In the intestine we also get pain when its walls are distended by flatus which cannot escape; and in the case of the bladder, when the urine is prevented, either voluntarily or involuntarily, from issuing when the viscus is fully distended, we have painful sensations, which may vary, just as in the case of the heart, from the slightest discomfort to the extremest agony. In all these hollow viscera distension leads to discomfort or pain in greater or less degree, but in the bladder at least the distension depends, to a certain extent, upon the amount of contraction in its wall; for if this contracts powerfully when the bladder is only about half filled, a distressing sensation and desire to micturate will be felt, which passes off entirely when the contraction ceases, and may remain absent for some time, although the bladder is gradually becoming considerably fuller than it was before. Again, contraction may set in accompanied by pain, and again this passes off, and alternate contraction and relaxation may continue until the bladder is fully distended and the pain becomes excessive, when it is relieved by evacuation, either through the natural passage, by rupture, or by operation. We see, then, that in the bladder discomfort or pain is due to the attempt of the viscus to contract against the resistance which it is unable for the time to overcome. I believe that the same is the case in the heart, and that *cardiac pain is generally due to weakness of the heart in proportion to the resistance which it has to overcome*. This may not necessarily mean that the heart is weaker than usual. It may be that the resistance is abnormally increased; though, on the other hand, it may also mean that while the resistance remains normal, the contractile power of the heart has become weakened, at least for the time.

Pain is usually of peripheral origin, and is useful in giving the organism a warning of some injurious condition which ought to be removed. Thus, pain in the bladder indicates the necessity for evacuating it, and leads the individual to take steps to accomplish this and to prevent injury; pain in a joint usually indicates some inflammation, and leads the individual to give it rest, and thus allow time for repair and restoration to health. But although pain is usually originated by peripheral irritation, the actual seat of painful perceptions is in the cerebrum, and intense sensations of pain may be felt by a patient although there is no peripheral cause for them whatever; and they are then almost certainly due to some condition of the perceptive centres in the brain. We find this in hysteria, where patients have complained of intense pain in the knee-joint, which has led to amputation of the leg, subsequent examination showing the limb to be absolutely healthy. But we may have pain which originates neither in the periphery nor in the centre, but in the paths which connect the two. Thus on striking the "funny bone" we not only get discomfort or pain at the point

where the ulnar nerve is actually struck, but we get disagreeable sensations in the fingers; and men whose legs have been amputated frequently suffer from pains which they refer to a corn on the amputated leg, although years may have elapsed since the member itself has crumbled into dust. The pain in such cases appears to be due to irritation of the nerves in the stump, which, like the blow upon the ulnar nerve, is referred by the sensory centres of the cerebrum—not to the nerve-trunk, but to the terminal filaments from which the nerves of sensation would ordinarily proceed.

In a similar way irritation of the sensory tracts in the spinal cord may give rise to intense pain, which is referred by the sensorium to the periphery, just as is the case in irritation of the nerve-trunks. Thus in sclerosis of the posterior columns we get lightning pains which are referred to the extremities, and also severe pain accompanied by disturbance in the stomach, intestine, and bladder. It is quite probable that the same thing may occur in regard to the heart, for Charcot notes that in the gastric crises of tabes the pulsation of the heart is usually violent and precipitate and the pulse markedly accelerated, although Rosenthal has seen a case in which the pulse was slower than usual during the attack. It is quite possible also that pain may be referred to the heart, although its seat may be entirely confined to the sensorium, and both the heart itself and the nerve-trunks and spinal cord, which connect it with the sensorium, may be quite healthy, just as in the case of the hysterical knee-joint. We know, indeed, that irritation of the trunk of the vagus nerve will produce a feeling of great discomfort in the cardiac region, just as irritation of the ulnar nerve will cause it in the fingers. But the heart is so readily affected by the brain that it is very difficult to find proof of any pain referred to the heart being of purely cerebral origin, and existing without any alteration in the heart itself. The vagus—or, as the Germans call it, *der Herumschweifendenery*, from its wandering course to the heart, lungs, liver, and intestines—is pre-eminently the nerve of emotion, and almost all the emotions can be expressed in terms of the vagus. Thus, "the heart beats high with hope," "his heart sank within him for fear." "his heart fluttered with anxiety,"—all express the effect of these emotions on the stimulating and depressing fibres of the vagus, or mixed effects on the two respectively. The borborygmi, which were used by the ancient writers as a synonym for compassion, the jaundice, which was ascribed to jealousy, and the well-known loss of appetite or sickness which bad news produces, indicates the actions of the intestinal, hepatic, and gastric branches of the vagus respectively.

One might be disposed to look upon emotions as entirely cerebral conditions, were it not that they manifest their effects so distinctly upon the organs just named; and upon the heart, especially, emotion may

act so powerfully as to cause death even in young and otherwise apparently healthy people. Thus Livingstone observed that a great number of slaves who had been torn from their homes died, and when asked what they suffered from they laid their hands upon their hearts, although they knew nothing whatever about anatomy. In many emotions, and especially those that are of a painful character and arise suddenly, the hand is naturally carried to the heart on account of the discomfort felt there. This discomfort, although caused by the emotion, is probably of a peripheral nature, for it may exist after the emotion itself has ceased, as I myself have experienced.

To recapitulate shortly, we may say that in all probability pain in the heart may arise either in the organ itself, in the sensory parts either of the nerve-trunks or spinal cord which connect the heart and sensorium, or in the sensorium itself, although any pure affection of the latter character is probably extremely rare. Though it is theoretically possible that pain referred to the heart may exist in the sensorium alone, it is nevertheless probable that in almost all cases emotional disturbance or other changes in the cerebrum lead to alterations in the function of the heart itself, and that these alterations, rather than the disturbance in the brain, give rise to cardiac pain.

But cardiac pain may differ not only in its origin, but in its nature, and it seems to me that we have at least two kinds of pain, one of which is felt as distension from within, so that the heart seems as if it would burst, while the other is felt as oppression from without, like a giant's hand compressing the chest. The feeling of bursting is familiar to many, for it occurs during or after exertions which are too great for those who undertake them, such as running quickly to catch a train, especially if carrying a heavy portmanteau, or trying to climb a Swiss mountain while out of training. That this condition is associated with actual distension of the right ventricle I had a good opportunity of ascertaining some years ago. In crossing the Théodule Pass at Zermatt my guides began to walk up a steep ascent so quickly that in attempting to follow I got an intense bursting sensation in the cardiac region, with dyspnœa. The discomfort led me to place my hand over my heart, and, to my astonishment, I found that the apex-beat had disappeared from its normal position and that there was marked epigastric pulsation. On calling to them to go slower, they slackened their pace, and as the cardiac discomfort and dyspnœa gradually disappeared I found that the apex-beat gradually left the epigastrium and returned to its normal position.

The heart has two sides and four cavities, and the bursting sensation may occur in any of them. Possibly it may be more usually felt in the ventricles, for the vascular districts of the systemic and pulmonary

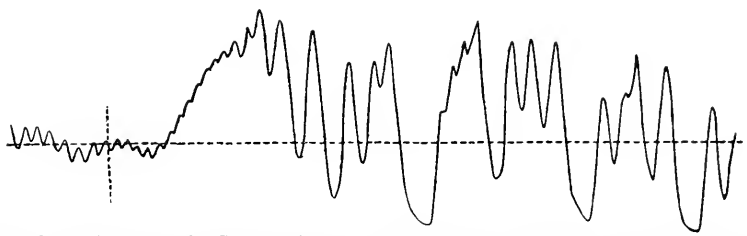
veins, with which the auricles communicate, will dilate if the tension in the auricles becomes too great, and will thus relieve over-distension. The ventricles, on the other hand, have no such means of relief unless their distension is extreme.

I have already pointed out that in the bladder the contraction of the distended viscus upon the fluid within it gives rise to pain, and probably the same occurs with the heart. The right ventricle, when much distended, may to a certain extent be relieved by some backward flow of blood through the tricuspid valves, but the left ventricle is not so favorably circumstanced in this respect, and one would therefore expect that over-distension in it would give rise to much more acute pain than in the case of the right ventricle. At the same time we should also expect that if the mitral valves were incompetent, so as to allow the left ventricle to relieve itself into the auricle and pulmonary veins, the pain of distension would never become so extremely great; and apparently something of this sort does occur. The second kind of pain is that of compression from without like the grasp of a giant's hand upon the thorax, and the name of *Beklemmend*, given to it by the Germans, is exceedingly descriptive. This sensation was first shown by Czermak to depend upon irritation of the vagus. He had a small exostosis upon one of his cervical vertebræ, and by pressing the vagus between his finger and the exostosis he was able to irritate it to such an extent as to slow his heart, and at the same time this sensation of *Beklemmung* came on. His experiments have been repeated by Concato and Quicke, and, indeed, any one by pressing firmly upon the vagus will probably soon experience a sense of oppression that obliges him to desist. Thus in severe migrain the pain in the head is often greatly or entirely relieved by firm pressure upon the carotid, but the thoracic oppression, which is probably due to the vagus being compressed at the same time as the carotid, soon obliges one to give up the pressure notwithstanding the great relief which it affords to the pain.

Pain almost exactly resembling that described by Czermak as the result of the compression of the vagus may be brought on by painful emotions. It may, however, exist completely apart from these emotions, and may persist after the emotion which caused it has passed away. I have noticed this in my own person, for one day while walking in Hyde Park I suddenly became conscious of a sensation of constriction or *Beklemmung* across the chest. It was so uncomfortable that it forced itself upon my attention, and I began to wonder what had caused it. I was walking slowly and the ground was level, so it could not have been exercise; but on puzzling over it I recollected that it had come on near a particular tree some hundred yards back, and that while passing that tree I had been thinking of some painful subject. The painful

thought had, however, completely passed away, and had been succeeded by others of an indifferent nature, and still the cardiac discomfort not only persisted, but increased, or at least engrossed my attention more. That painful emotions affect the heart through the vagus has been very clearly shown by Couty and Charpentier, as is illustrated in the accompanying tracing, which they obtained by connecting a kymograph with the arterial system of a dog paralyzed by curare (Fig. 52).

FIG. 52.



Effect of Emotion upon the Pulse and Blood-pressure in a Curarized Dog. The dotted horizontal line indicates the ordinary level of the blood-pressure; the upright dotted line indicates the time when another dog began to howl, and thus excited the animal experimented on. (After Couty and Charpentier.)

The cries which another dog uttered on its toes being trod upon produced in the curarized dog very much the same effect as would have been caused by strong stimulation of the vagus. At the same time, however, it will be noticed that the vaso-motor centre appears also to have been stimulated, and the arterioles consequently contracted; for, despite the slow action of the heart, the blood-pressure is considerably raised, and only falls below the normal during an exceptionally long diastole of the heart. That this slowness of the pulse is due to the effect of emotion on the heart through the vagus is shown in another

FIG. 53.

This tracing shows the effect of Emotion on the Blood-pressure in a Curarized Dog. The effect on the pulse is prevented by previous section of the vagi. The dotted lines have the same signification as in Fig. 52. (After Couty and Charpentier.)

tracing taken under similar circumstances, with the important exception that the vagi has been previously divided (Fig. 53). Here it will be seen that emotion greatly raises the blood-pressure without

slowing the pulse. This rise of pressure, due to emotion, is, I believe, a very important factor in the production of angina, and I shall return to it again later.

It is evident that emotion may have a very complex effect upon the heart, and may under different circumstances produce the feeling of *Beklemmung* due to the action of the vagus, or may give rise to the feeling of distension produced by the excessive resistance which contracted arterioles oppose to the flow of blood through them, and the consequent difficulty the heart has in emptying itself. This feeling is also mentioned in popular language, for people frequently say their hearts feel as if they would burst from grief.

It must be borne in mind that the inhibitory fibres of the vagus not only cause the heart to become slower and weaker, but they tend also to make it dilate beyond its normal size; and such dilatation, it appears to me, renders the organ still more susceptible to the effects of a distending force from within.

The expression "a broken heart" is not found to correspond with the result of *post-mortem* examination; but a persistent cardiac pain, ending in death, may be originated by grief, as in the case of the slaves observed by Livingstone, to which I have already alluded. Of course in such cases as these it is exceedingly difficult or impossible to decide how far the cardiac depression was an exciting or merely a predisposing cause of death; for the weakened circulation would render the slaves more liable to succumb to infectious diseases, malarial or otherwise, by which they might be attacked.

In trying now to apply the physiological data which we have already obtained to the explanation of cardiac pain in general, and of angina pectoris in particular, we may recapitulate in a few words the facts already mentioned. These are that distension of any hollow viscus, as a rule, acts as a stimulus to pain. This pain usually increases with the amount of distension, or rather with the amount of stretching force exerted upon the muscular fibres of the hollow viscus. Thus in the bladder discomfort or pain becomes greater as the bladder gets fuller and the muscular fibres become more stretched; but a spasm of increased pain may and does come on when the bladder contracts. This contraction increases the pressure upon the contents of the bladder, but at the same time it also increases the pressure exercised by the contents upon the bladder-walls, and when these relax so that the pressure again diminishes the pain caused by their stretching tends to cease.

In discussing angina pectoris it may help us if we bear in mind that the most marked symptom of angina is pain—that it is really pain in the heart, though it may be very difficult to draw the line exactly between what every one would call pain and slight forms of cardiac

discomfort which no one would call angina; but between these two extremes we find many intermediate forms, differing from one another by very slight degrees, so that hardly any difference may be distinguishable between adjacent members of the group, although the extreme members may be very different indeed. As Dr. Grainger Stewart pointed out, the analogy between the heart and the bladder may help us considerably. While the bladder, stomach, intestine, as well as the heart, all consist of hollow bags of involuntary muscular fibre, both the heart and bladder have a certain resistance to overcome —namely, that afforded by the friction of the urine passing through the urethra, and the resistance caused by a contraction of the sphincter vesicæ in one case, and the friction of the blood in the arteries along with the contraction of the walls of the arterioles in the other. In both cases there are nervous arrangements for preventing the over-distension of the viscus, and when the pressure in the bladder becomes great the sphincter relaxes. When that of the heart becomes too great the vessels dilate or the heart itself goes more slowly. In both cases we find that the nervous arrangements may be disturbed, so that spasmodic retention may occur in the bladder and over-distension in the heart. In both cases over-distension is associated with pain, and I believe that in both cases the amount of pain may vary, as I have already said, from the slightest discomfort to the severest agony.

But distension only occurs when the contraction of the muscular walls of a hollow viscus is not sufficiently powerful to overcome the resistance opposed to the exit of its contents. Whenever the resistance yields, and the bladder, stomach, intestine, or heart is allowed to empty itself, the pain is relieved or disappears entirely; but in the case of the bladder or the stomach we sometimes find that the muscular fibres of the walls remain in a state of contraction or spasm so great that a few tea-spoonfuls of fluid seem sufficient to produce a sensation of distension and excite the organ to renewed contraction. It is quite possible that a similar condition may sometimes occur in the heart, and that the "irritable heart" and "irritable bladder" may be perfectly comparable to each other; but neither of these conditions gives rise to intense pain, unless there be some obstruction to the heart or the bladder emptying itself of its contents. We may, I think, lay it down as a rule that intense pain in any hollow organ is due to distension arising from the inability of the organ to empty itself of its contents. It is evident that this inability may be of twofold origin: it may be due either to increased resistance, or to the diminished power of the expulsive muscles. In applying this general rule to the case of the heart we may say that cardiac pain is dependent on increased resistance to the onward flow of blood, or diminished power in the heart itself. It is evident that a combination of these two factors will

be still more likely than either one alone to produce cardiac pain, and in searching for the cause of angina pectoris we are most likely to find it in a combination of those leading on the one hand to cardiac weakness and on the other to increased resistance.

It will, perhaps, be most convenient to discuss first the conditions which give rise to increased pressure in the aorta and the arterial system generally. The first is mental emotion, as shown in the tracing already given; the second is bodily exertion. There are few physical conditions, if any, which raise the blood-pressure in an animal so high as does sudden exertion or struggle. The cause of this probably is that the arteries passing through the muscle become compressed by the thickening of the fibres which occurs during muscular contraction; but a counterbalancing condition occurs at the same time, for the muscular fibres which form the walls of the arteries dilate at the time when the muscle contracts. The consequence of this is that the flow of blood through a contracted muscle may vary considerably; sometimes it may be stopped entirely, at other times it may be diminished, while at others, again, it may be considerably increased above the normal, according as the mechanical pressure upon the muscular arteries or the dilatation of their walls is most marked in the particular instance. In almost all cases, however, the flow of blood through the muscle after its contraction becomes greater than usual, an increased supply of blood being apparently requisite for mammalian muscles to perform their functions thoroughly. In consequence of this twofold condition in muscles it frequently happens that while sudden exertion may raise the blood-pressure in the aorta, continued exercise may rather lessen it, the mechanical effect of the muscular contraction upon the arteries being more evident at first, while afterward the arterial dilatation is more evident. A third cause of rise in arterial pressure is sudden stimulation of a sensory nerve; and a fourth is the application of sudden cold, either to the surface of the body or to the stomach, giving rise to contraction of the vessels of the surface or of the digestive tract, and thus causing a rise of general pressure.

The exciting causes of angina pectoris are precisely those which I have just mentioned as raising the blood-pressure.

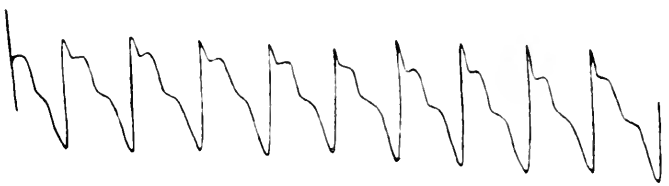
The effect of emotion is well shown in the case of John Hunter, and the most common cause of angina pectoris is the exertion of walking up a hill; but in such cases, especially where the disease is just beginning, though the attempt to ascend a hill may cause pain at first, yet afterward, if the pain passes off and the exertion be continued, the individual may be able to walk for miles, and indeed make considerable efforts, without any return of the pain; which is precisely what we would expect from what has already been said regarding the condition of the vessels in the muscles after continuous exercise.

But the rise in pressure which we have just been considering can only be looked upon as an exciting cause of angina pectoris, for it does not occur in healthy people. One condition which is very apt to lead to angina pectoris is gouty kidney, for this is associated with a high blood-pressure due to diminution in the calibre of the systemic arterioles. Although it is unnecessary to discuss here whether this diminution in calibre is due to a thickening of the walls of the arterioles by arterio-capillary fibrosis, as believed by Gull and Sutton, or to contraction of the muscular walls of the arteries, as thought by George Johnson, it is evident that where the pressure is already high, as in the case of a man suffering from gouty kidney, any sudden increase in it, either from emotion or exertion, is more likely to cause distension of the heart and consequent pain. Yet there are many men suffering from gouty kidney who do not get angina pectoris, and we must now look for its causes not only to the arterial system and the resistance which the heart has to overcome, but to the power of the heart itself in counteracting this resistance. When we come to analyze post-mortem appearances in cases of angina pectoris, we are at once struck by the fact that in the great majority of cases conditions are present which either weaken the heart considerably or tend to lessen its power of meeting, by increased contractile power, any call that may be made upon its powers by a sudden rise in the resistance it has to overcome.

A fatty condition of the heart is naturally one of the most powerful causes of lessened contractile power, and fatty heart has been frequently noted as a post-mortem appearance in cases of fatal angina pectoris; but an inelastic condition of the aorta, with calcification of the coronary arteries, has been noted much more frequently still. At first thought it is difficult to understand what connection a calcified condition of the coronary arteries can have with pain in the heart itself; but when we remember that one of the concomitants of muscular action is dilatation of the vessels which supply the muscle with blood, we can understand that rigid arteries, rendering such an increased supply impracticable, might naturally lead to weakened contractile power, and therefore to pain. In addition to this there may be another factor, and that is disturbed nervous supply; for the interior of the aorta is naturally sensitive, and mechanical irritation of it has been shown by François-Franck to lead to wide-reaching reflex results, among which modification of the respiration is well marked. Such disturbance may in its turn lead to increased resistance to the onward flow of blood, and this in its turn to cardiac distension. That some such disturbance is a powerful factor in the production of pain in angina is, I think, clearly demonstrated by the tracings which I took in a case many years ago, and which first led me to use nitrite of amyl as a remedy for the disease. In a healthy body increased tension within the blood-vessels stimulates the vagus

roots and causes the heart to beat more slowly, so that, less blood being thrown into the arterial system, the diminished outflow through the arterioles is compensated and the pressure remains nearly normal; but in this case I found that simultaneously with the appearance of pain

FIG. 54.



Normal Pulse.

the pressure rose and the pulse became exceedingly rapid (Fig. 55). The form of the pulse-tracing showed that the arterioles were greatly con-

FIG. 55.

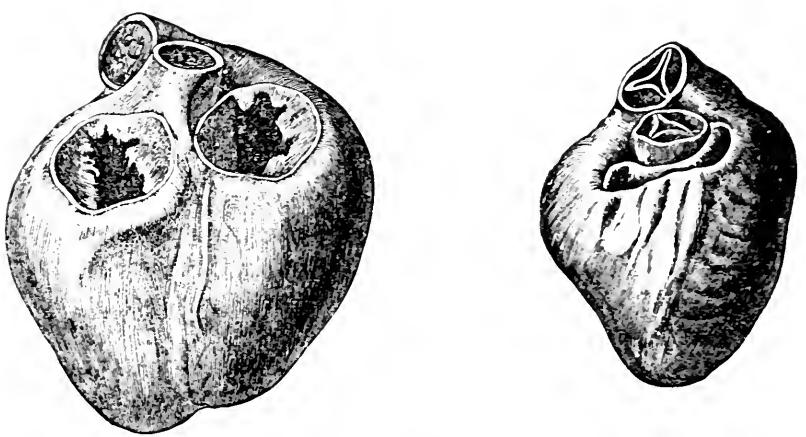
Pulse during Severe Pain.

tracted—so much so, indeed, that during the cardiac diastole a very small proportion of blood was able to flow into the veins, and consequently the pressure remained high during the diastole, instead of sinking as it would ordinarily have done. In this case, which was one of angina pectoris with aortic regurgitation, the blood had an opportunity to run backward into the heart, as well as onward through the arterioles into the veins, and yet the tension remained high during the diastole. This condition can only be explained by contraction of the arterioles, and the high tension which would necessarily result in the heart is, I think, the cause of the pain. This idea, taken in connection with the fact that bleeding usually relieves the patient for the time being, led me to use nitrite of amyl, and the result completely confirmed my expectations. But it may be said that my observations disproved my hypothesis, because I found that after relieving the tension in the arterial system by the use of nitrite of amyl pain still might persist, though to a less extent. This, however, I believe, was probably due to the right side of the heart being involved as well as the left; and when the drug had completely produced its physiological action of dilating all the vessels in the body, the pain disappeared and did not return.

I have already drawn attention to the fact that relief to distension lessens the pain in hollow viscera, and from this fact we naturally expect that the right side of the heart would suffer less than the left, because the right ventricle, when over-distended, is more readily

relieved by the auriculo-ventricular orifice dilating and the blood regurgitating into the auricle and veins between the flaps of the tricuspid valve, which then became incompetent to close the dilated orifice. Dilatation of the mitral orifice occurs much less readily, and therefore the distended left ventricle cannot relieve itself so easily, and is much more likely to suffer pain in consequence. It has been noted, however, that when mitral regurgitation occurs the pains of angina pectoris become less frequent and severe, or may disappear altogether in cases in which they formerly existed. (See Fig. 56.)

FIG. 56.



The Heart in Full Dilatation and in Full Contraction. It will be seen that in complete dilatation the auriculo-ventricular valves, though healthy, can with difficulty close the dilated orifices.

In children also, where the cardiac walls are much less hard and resistant than in adults, we would naturally expect angina pectoris to be much less frequent, as the left ventricle would be likely to discharge itself into the left auricle and pulmonary veins, in much the same way that the right ventricle does in adults. Eichhorst mentions two cases of children in whom angina pectoris occurred. One case was that of a boy aged fourteen years, who was suffering not merely from aortic incompetence, but from mitral stenosis; and in this case one would expect that the contracted mitral valve would tend to prevent any free dilatation of the mitral orifice and relief of the ventricle by free regurgitation. In the other case, which was that of a boy aged eleven years, the auriculo-ventricular ring was to a great extent calcified, so that the enlargement of the mitral orifice and regurgitation would be prevented.

The factors which we have now considered in the pathology of angina pectoris seem to indicate that the pain is due in most cases to cardiac distension, caused by the resistance in front being too great for

the ventricle completely to overcome it, while at the same time relief by regurgitation is prevented. The increased resistance may be either absolute or comparative. It may either be greater than that which would occur in a healthy person, or may simply be too great for a weakened heart, although probably in most cases the resistance is above the normal and the cardiac power is below the normal. In all cases, however, there is a disturbance of the vascular nervous mechanism, which would tend, either by slowing the heart or dilating the vessels, to adjust the action of the one to that of the other, and thus to keep the blood-pressure at the proper height, neither allowing it to fall too low nor to rise too high. The nervous mechanism, in all probability, may undergo central disturbance, and thus we may have attacks of angina pectoris of an epileptic or hysteric nature, and more especially they may be caused by emotional disturbances. We may also have them from disease of the nervous paths in the spinal cord, as in the case of locomotor ataxia, or of the cardiac nerves, as by tumors; and in all probability we may have also reflex disturbance, caused by derangement of other organs. One case which I saw some years ago was probably an instance of one or other of the last-named varieties, though it would be hard to say whether the pain was due to implication of nerves or was reflex from a neighboring part of the body. The case was that of a man aged thirty-six, who complained of pain in the chest under the left nipple, shooting through to the back and running down the left arm as far as the elbow. During the attacks his medical attendant found that the pulse was not quite regular and that the face was pale. He had taken nitrite of amyl, but it seemed only to make him worse. On pressure over the sternum opposite the second and third costal cartilages I found that it was excessively tender and slightly swollen. I learned that he had suffered from syphilis twelve years before. I advised the use of iodide of potassium. In a short time after beginning the drug his pain left him and did not return. Here the anginal pain might be due to reflex irritation from a commencing node over the sternum, or might possibly be due to thickening, involving some of the cardiac nerves.

The high arterial tension which occurs in cases of gout is a very powerful agent in bringing on the attacks. Not only does the arterial tension do this directly by the increased resistance it offers to the heart, but gout is frequently liable to render patients very irritable and give rise to those emotional disturbances which are sometimes fraught with such fatal consequences. For both reasons, therefore, it is very important to cause free elimination both from the bowels and from the kidney.

In a case which I saw lately, a seaman aged thirty-nine, with a hypertrophied heart and a soft systolic murmur at the apex, the pain

came on acutely over mid-sternum, and was limited to an area the size of a crown-piece opposite the insertions of the fourth and fifth cartilages. Nitro-glycerin did him no good, and when walking he was obliged to stop every fifty yards on account of the pain. Iodide of potassium, in 10-grain doses thrice daily, greatly relieved him, but he seemed to receive more benefit from sulphate of magnesium, in drachm doses three times a day, than from either of the other remedies.

A form of elimination not much in vogue, but which is sometimes exceedingly useful, is bleeding, and in the case in which I first used nitrite of amyl bleeding invariably prevented the recurrence of the pain for one night, when without it an attack would have been certain to occur. The natural indication for relieving the pain at the time is certainly to lower the blood-pressure, and this is most rapidly and efficiently done by the administration either of a nitrite or of some other substance which acts in the same way as a nitrite. Nitrite of amyl is the one which is the most commonly used, but, according to the recent researches of Cash and Dunstan, the nitrites which act most powerfully are the following, the first being the most energetic: (1) secondary propyl; (2) tertiary butyl; (3) secondary butyl; (4) isobutyl, nearly equal; (5) tertiary amyl; (6) α-amyl; (7) β-amyl, nearly equal; (8) methyl; (9) butyl; (10) ethyl; (11) propyl.

Of these substances, the isobutyl has already been used with good effect. Along with Mr. Tate, I investigated the physiological action of nitro-glycerin in 1876, and showed that its action was the same in character as that of nitrite of amyl. On account of the headache which it caused Mr. Tait and myself, I hesitated to give it to patients, but in the following year it was successfully introduced into medical practice by Dr. Murrell. Both nitro-glycerin and nitrite of sodium, recommended by Dr. Hay, have the advantage over nitrite of amyl that they can be more readily used to keep up a steady diminution in the blood-pressure, and the plan of giving small doses of nitro-glycerin at frequent intervals during the day is sometimes most advantageous. The best way of doing this is to break up a chocolate nitro-glycerin tabloid into many pieces, which are put into a *bonbonnière*, and one of them taken every ten minutes or quarter of an hour. In this way the action is never very great, but is kept up with a considerable amount of constancy during the whole day. Some experiments which Mr. Bokenham and I have made with hydroxylamine have shown it to have an action almost exactly like that of nitrite of amyl, and I intend shortly to try it in angina pectoris, where I expect it will probably have a beneficial action.

But while we may try to avoid sudden increase of tension from exercise or from emotion, and to diminish the excessive tension in cases of gouty kidneys by free elimination and by an almost entirely

vegetable diet,—while we may lessen the tension during the attack by nitrites and allied remedies, we must think at the same time of the enlargement of the heart and try to increase its force as best we can.

The first and foremost, perhaps, amongst the drugs that are really efficient in tending to prevent the recurrence of the attacks in angina pectoris comes iodide of potassium in doses of 5 to 30 grains three times a day. Whether this acts as a simple eliminant, or whether it tends to increase the blood-supply to the heart by causing absorption of the deposits which block the coronary arteries, or whether it acts in some other way, we cannot at present tell, but about its practical use there can be no doubt whatever. In cases of fatty degeneration we may combine elimination with the administration of iron and of arsenic, and Oertel's method of gently graduated exercise may be beneficial if used with great caution, but if used carelessly it may be most injurious and greatly shorten the patient's life.

In conclusion, I ought to say a word about tobacco. In a healthy person it tends to cause great cardiac derangement; in some it produces great irregularity of rhythm and the patients complain of palpitation; in others it causes sudden faintness, so that the patient drops down insensible as if he had been shot. The first kind of tobacco-heart I have seen is almost entirely in working-men, who smoke a coarse tobacco; the second form I have seen in those belonging to the upper classes, who have smoked fine tobacco. Besides its effect upon the heart, tobacco has a most extraordinary power to contract the vessels, and perhaps there is no other drug that in a somewhat large dose can raise the blood-pressure so rapidly and so much as nicotine. It must not be concluded, however, from effect of these poisonous doses that smoking in great moderation is certain to be injurious. Each individual case must be judged upon its own merits, and while moderate smoking may be allowed in some, it must be entirely forbidden to other patients suffering from angina pectoris.

DISEASES OF THE BLOOD-VESSELS.

By FREDERICK C. SHATTUCK, M. D.

Diseases of the Arteries.

Acute inflammation of the inner and middle coats of the arteries is relatively rare, and more apt to result from the irritation of an embolus than from any other cause. It is manifest that treatment is possible only when a peripheral vessel is affected, and it is then comprised in rest—local, general, or both—soothing applications, and morphine or other anodyne if pain demands their use. Should aneurism develop, surgical measures alone are in order.

Periarteritis, the result of injury or of the extension of inflammation from surrounding parts, also comes within the province of the surgeon rather than of the physician: if an accessible abscess forms, it should of course be opened.

Chronic inflammation (atheroma, arterio-sclerosis, endarteritis deformans), so often combined with degenerative processes, does not present a very fruitful therapeutic field. Could we prevent syphilis and the abuse of alcohol, could we ensure everybody against excessive bodily and mental strain, we should go far to obviate the necessity for trying to treat these arterial changes and their allies, concomitants, and results; at least until a late period of life. Plumbism is, according to English writers, a preventable cause which is worthy of mention.

It is not often that the physician has the opportunity in connection with this disease to exercise his highest function—prevention. Changes are usually more or less advanced when their subjects come under observation. As is indicated above, the chief means of prevention consist of a strictly hygienic manner of life. There is reason to believe that arterio-sclerosis may be a matter of inheritance, but that the tendency can be effectually combated or delayed by temperance and moderation in all things—food and drink, work and play—and by the cultivation of an equable temper. It is highly probable that the wear and tear of modern life, the fierce struggle for wealth and position, prove as disastrous to the integrity of the arterial walls as does a life of ease with its temptations to over-indulgence of the appetites and to sloth of mind and body. It is to be hoped that this latter tendency may be counteracted by the favor now shown to athletics, and

by the habits of self-denial which their pursuit entails to a greater or less degree on all their votaries. At the same time, we recognize the dangers of indiscriminate and undue indulgence here as well as elsewhere.

Endarteritis may be more or less general, or it may be local. The local form, as seen especially in the brain, heart, and kidneys, does not lie within the scope of the present article. The treatment of the general variety should be causal as far as is possible—not far usually, it must frankly be stated. The arteries which are the favorite seat of syphilitic changes are those of the brain. It is, moreover, impossible to be sure whether a syphilitic arteritis has gone beyond the point up to which retrogression may take place under the use of potassium iodide and mercury. The patient should therefore be given the benefit of the doubt and full antisyphilitic treatment.

Apart from those cases in which the changes can be reasonably laid at the door of syphilis, the treatment of arterio-sclerosis varies with the presence or absence of compensatory cardiac hypertrophy. If this be present, it should be our aim to maintain it by careful regulation of the diet and exercise. The nutrition of the heart-muscle depends primarily on the free circulation through it of healthy blood in sufficient amount, while the main source of the blood is, of course, the food. This should be simple, nutritious, easily digested, and given in such amount and at such intervals as the individual case seems to require. A constant supply of pure air and sufficient sleep are of the greatest importance. Careful and specific directions should also be given as to the amount and character of exercise, bathing, and clothing, it being remembered that the kidneys are seldom perfectly sound in these cases. It is almost impossible here to do more than indicate general principles. Success depends on the thoroughness of the physician and on his skill in individualizing his patients and inducing them to carry out his injunctions, however unwilling they may be to do so. But it is not enough to see that the conditions for the formation of healthy blood are met: its purification must also be ensured. The measures of general hygiene above alluded to minister to this end, but they must be supplemented by careful attention to the bowels and kidneys. The retention of excrementitious products is believed to be a potent cause of increase in the arterial tension, a continuance of which favors changes in the vascular walls, and also makes greater demands upon the left ventricle—demands which in time can no longer be met, and which hasten the predominance of dilatation over hypertrophy. In fat and plethoric persons limitation in the fluid ingested, further reduction in the blood-mass by watery catharsis at stated intervals, and graduated exercise should be cautiously combined with suitable diet. The essence of the various and apparently conflicting systems for the reduction of

corpulence is simply an avoidance of excess. But all efforts in this direction should be well considered and tentative, and the reduction must, above all, be very gradual.

In cases of general atheroma we are between two fires. If the heart is weak, nutrition suffers; if it is strong, there is danger of the rupture of a cerebral artery or miliary aneurism. Hence the obvious necessity of avoiding over-, and especially sudden, exertion. There are, in many cases, no certain means of arriving at accurate knowledge of the condition of the cerebral vessels. If the radials and temporals are diseased, so are presumably also the vessels of the brain. But the latter may be the seat of advanced changes, although the former appear healthy. We must therefore often take the chances and follow general principles. It is, moreover, notorious that individuals whose peripheral arteries are calcareous to the last degree not infrequently enjoy a life of surprising length and comfort.

The drug-treatment is always of secondary importance, except where the vascular change is of syphilomatous nature. Here potassium iodide should be given in initial doses of 10 or 15 grains thrice daily, and it is probable that the simultaneous administration of mercury tends to render the effects of the potassium salt more permanent. If the symptoms are urgent or do not promptly show signs of yielding, the iodide should be increased steadily and more or less rapidly until either the desired effect is produced or the drug disagrees. Improvement or iodism are the indications for dosage, not the number of grains. A convenient manner of administering the drug is in concentrated aqueous solution, 1 minim of which represents about 1 grain. Free dilution is important, and milk will often be found a good vehicle. In some cases large doses are well borne although small ones provoke discomfort. It is not, perhaps, a matter of great importance what mercurial is used, unless it is desirable to bring the system rapidly under the influence of the remedy; in that case inunction is generally admitted to be the best. But inunction is a dirty, time-consuming, and tell-tale method, to which others are in ordinary cases to be preferred. The protiodide in $\frac{1}{6}$-grain pills is a convenient form, but should never be given at the same time as the potassium iodide, lest the more poisonous biniodide of mercury be formed. By giving the potassium iodide fifteen minutes before meals and the mercury after meals, all danger is avoided. The number of pills can sometimes be gradually increased with advantage up to six or nine a day, the usual precautions being taken against salivation.

We are acquainted with no drug which can very materially influence endarteritis of other than specific origin. The treatment must here be emphatically of the patient, rather than of the disease. Potassium iodide is often given, more commonly in doses of under

rather than over 10 grains, three times a day. Bartholow and some others claim that salts of gold have the power to prevent the formation or to cause the absorption of connective-tissue growth, and are hence indicated in arterio-sclerosis. The remedy is generally given in the form of the double chloride of gold and sodium, $\frac{1}{20}$ to $\frac{1}{10}$ grain after meals.

In cases of persistently high arterial tension the labor of the heart can be lightened by the use of the nitrites. Of these the most convenient and stable is nitro-glycerin, the ordinary dose of which is 1 minim of the 1 per cent. alcoholic solution. This is now to be had in tablet triturates, for elegance and convenience leaving nothing to be desired. One of these can be given from two to six times a day, according to circumstances, among which is to be reckoned individual toleration. In some persons the dose must be smaller, but it should never be pushed to the point of headache and flushing of the face, except for the purpose of determining the limit of toleration. The relaxant effects of the nitrites on unstriped muscular fibre are certainly remarkable. Diuretics, diaphoretics, and purgatives may be so used as to do good service in cases of high tension.

If the compensatory hypertrophy of the heart is failing or has failed, the indications for treatment become quite different. The leading one of these is the restoration of sufficient vigor to the heart-wall, if this be possible. Rest is here imperative, except in cases of obesity with presumable large accumulation of fat in the subpericardial tissue. In such cases the treatment known by the name of Oertel may be applicable, but only under the careful supervision of an intelligent and cautious physician. In combination with rest, a nutritious diet with frequent small meals, an abundant supply of fresh air of moderate temperature, with proper precautions against chill—a weak heart presupposes a poor circulation—and freedom from excitement and worry are of the greatest importance. Alcohol is here indicated, especially if the appetite and digestive power are impaired. As to the form, no absolute rule can be laid down, but in the majority of cases whiskey and water is the best. It may be necessary to stimulate the appetite also by one of the vegetable bitters before meals, of which nux vomica or strychnine is the best. The value of strychnine is not only in its stimulating action on the gastric mucous membrane, but also in its tonic effect on the heart, and probably the vessels. If there is any tendency to angina, this drug, if used at all, should be given with great caution and only in small doses.

The natural digestants, pepsin and hydrochloric acid, are usually not necessary, the feeble digestion being largely dependent on sluggish circulation and consequent defective secretion, and thus tending to mend with an increase in heart-power. This is to be striven for

with the aid of digitalis or one of its allies. If it be true that digitalis increases arterial tension, while strophanthus does not, this is a class of cases in which the latter is to be preferred. But it is probable that this difference in action is, in the present state of our knowledge, somewhat theoretical; and most of us in practice turn first to digitalis: if this disagrees or fails, the other members of the group—strophanthus, convallaria, sparteine, adonidine, caffeine, helleboreine, etc.—may be used in turn. Special care should be taken to guard against overdosage with any of these remedies, omitting them, at least temporarily, when the quantity of urine reaches or nearly approaches the normal. If it is desirable to continue digitalis for some time, the valuable suggestion of Balfour may be followed—to give it, namely, only twice a day, the doses being separated by an interval of twelve hours. Danger of cumulative action is thus largely obviated, and the drug may be taken steadily for long periods with great benefit in some cases. The effect of the diffusible cardiac stimulants is only transitory, but aromatic spirit of ammonia, compound spirit of ether camphor, musk, and the like may be so used as to render valuable service.

Sleep is of the utmost importance, and must be secured by artificial means if it does not come naturally. Morphine is often the best hypnotic in these cases, quite apart from asthmatic and anginose attacks, in which it is nearly indispensable. Of the less powerful hypnotics, those which, like chloral and the modern antipyretics, tend to depress the heart, are to be shunned.

Degeneration of the arterial walls occurs in three forms—fatty, amyloid, and hyaline. Of these the most common is the former, but it is almost always so closely associated with changes which are classed by pathologists as chronic inflammatory that it has been already considered in the previous pages. It only remains to add here a word as to the tendency of anæmia, resulting in deficient oxidation, to provoke fatty degeneration. The therapeutic bearing of this fact is sufficiently obvious.

Amyloid change in the vessels may be inferred if its presence can be recognized clinically in the liver, spleen, or kidneys, and not otherwise. The treatment, of course, is that of the chronic syphilis or suppuration to which the change is secondary. Hyaline degeneration cannot be recognized during life, and consequently requires no further mention here.

Arterial thrombosis is the result of a feeble blood-current and of roughness of the inner coat of the vessel, or else it forms behind an embolus partially or totally occluding the lumen. This statement indicates the line which prevention should follow as far as is possible. After occlusion has taken place our efforts must be confined to such

measures as favor the establishment of collateral circulation. If a cerebral or visceral vessel is thus affected, all we can do is to enforce rest and strengthen a weak heart-beat: the necrosis of gangrene which may follow the plugging of an important artery of an extremity may render amputation necessary. An underlying diabetes must not, of course, be overlooked.

Embolism of an internal artery offers, perhaps, even less opportunity for treatment than does thrombosis, in that the heart is less likely to need stimulation. Potassium iodide is often given, but there is no evidence that it is of real service unless syphilitic arteritis is present: even then the drug cannot, in all probability, promote the absorption of an embolic or thrombotic plug or restore life to necrotic tissue, though it may do much to prevent recurrence of occlusion. Prevention of the formation of endocarditic vegetations is but little within, that of their detachment is quite beyond, our power at present. Embolism of a main branch of the pulmonary artery is immediately or rapidly fatal: if a medium-sized branch is affected, the heart is likely to demand prompt stimulation, but thrombosis often works backward toward the right ventricle. Infarction of a lobular branch is often latent and requires no treatment, even if diagnosed, unless it is followed by pleuritic pain. In splenic and renal embolism also pain is the sole indication for treatment. Embolism of a large branch of a mesenteric artery may occasionally be recognized during life, but we can do little or nothing for it beyond keeping the patient alive as long as possible. Emboli from a foul source are liable to be followed by suppuration, and the resulting abscess, if accessible, is to be opened as early as may be. The writer has seen such abscesses, seated in the skin and derived from malignant endocarditis—which, in its turn, was secondary to dysentery—spread for a time and then heal perfectly, though the patient finally died. The treatment of cerebral embolism will be found in another part of this system.[1]

Fat embolism of the lungs, generally the sequel of trauma with laceration of fat tissue, is not amenable to direct treatment.

Dilatation of Arteries—Aneurism.

Under this head it is proposed to consider aortic dilatation and aneurism alone, these conditions of peripheral vessels belong eminently to the surgeon.

The indications for the treatment of aortic aneurism are simple enough. Obliteration or contraction of the sac is the end desired, and the chief medical means of its accomplishment is reduction in the force and frequency of the heart-beat, with an increase, if possible—but at least no diminution—in the coagulability of the blood.

[1] See article on Apoplexy, etc., in Vol. III.

The difficulty lies in meeting these indications, and is twofold. Our means are so very seldom productive of anything more than palliation, and most of them are so severe, that a physician thus affected would generally prefer a shorter life—if, indeed, that is to be called life which consists in absolute disability for a prolonged period without any reasonable prospect of radical benefit—to subjecting himself thereto. Drs. Murchison and Hilton Fagge worked to the last. But most of our patients are not physicians and, perhaps happily for them, cannot take a physician's point of view. There is no question, moreover, that life can be prolonged and suffering alleviated in most cases, while here and there in medical literature reported cases of cure are to be found. At all events, it is certainly our duty to do all that we can in every case.

The leading principle of management, the diminution of intra-vascular pressure, has been recognized since the days of Hippocrates, and was carried to its logical extreme by Valsalva, though his repeated bleedings have fallen into disuse, because we believe that they tend to defeat their own object, in that under them the irritability and frequency of the heart are increased. Restriction in diet also, if carried too far, lessens the coagulability of the blood. The purely medical treatment of the present day, therefore, is mainly that of Tufnell, though the limitation of the ingesta is not usually carried to the full extent recommended by him. His dietary is—2 ounces of bread and butter and 2 ounces of milk for breakfast; 2 or 3 ounces of bread and 2 or 3 ounces of meat for dinner, with 2 to 4 ounces of milk or claret; 2 ounces of bread and 2 ounces of milk for supper. With this is to be combined the maximum degree of bodily and mental rest, sudden exertion or emotion being especially shunned. Straining at stool is to be guarded against; coitus is to be forbidden. This treatment makes such demands on the self-control and fortitude of a patient that it can be very seldom carried out for a sufficiently long period to yield its best results, especially as we cannot hold out much hope of a real cure. And it may be added here that the nature of his trouble and the rationale of the treatment should be set forth to the patient with a fulness which must depend on his character and his circumstances as influencing the rigidity of the course to be pursued. In actual practice a larger liberty is, and must usually be, allowed than is above set down. We must do the best we can with each patient, keeping constantly in view the main principle of avoiding unnecessary, and above all, sudden, exertion. This principle is not invalidated by the very rare cases in which the subjects of aortic aneurism have led active, perhaps laborious, lives for periods that one would have said to be impossible.

The drug-treatment is limited to opium or other anodynes for pain, and sedatives or hypnotics as adjuvants or promoters of rest; the only

direct remedy which can claim any really trustworthy evidence of success is potassium iodide. The constipating tendency of opium and its derivatives must be guarded against; but the danger of acquiring the opium habit need not weigh heavily on our minds here if pain can be alleviated or wearing discomfort markedly lessened. If the same end can be attained by chloral, phenacetin, or its congeners, etc., so much the better. Balfour is a very prominent, though he was not the earliest, advocate of the employment of potassium iodide, the good effect of which seems to be more clear than does its mode of action. Balfour thinks that this is "mainly by some peculiar action on the fibrous tissue, whereby the walls of the sac are thickened and contracted, while if coagulation should take place within the sac, it plays but a very secondary and unimportant part and depends for its occurrence solely on the condition of the blood, and is in no respect due to the iodide of potassium." Bramwell doubts the occurrence of this hypertrophy. Both lay stress on the influence of the drug in reducing the blood-pressure and relieving the tension within the sac. Balfour does not now advocate such large doses as he did at first. The blood-pressure is to be lowered without increasing the frequency of the pulse. A case coming under treatment is therefore to be put to bed for a few days without medication until the normal pulse-rate of that individual while at rest can be determined. Ten grains of the iodide are then to be given thrice daily, and the dose is to be gradually increased, provided that the pulse-rate does not rise: Balfour finds that 15 grains is the maximum, 10 often the better, dose. It should be continued for months. He believes that, even without rest, the drug can render great service. No other remedy is used so much in the treatment of aortic aneurism at the present day, and it is generally given in larger doses than seems to Balfour desirable in the light of his later experience.

The application of an ice-bag over the tumor often allays pain, and may possibly promote coagulation. We are cautioned to be very careful in its use if the walls are thin or the skin discolored, lest rupture be hastened through impaired nutrition of the cutaneous layer. Ice over the heart itself tends to moderate its action, and may thus be distinctly serviceable. A small venesection is said sometimes to relieve pain markedly, and should be tried if milder means fail. The chloride of barium may be given in pills of $\frac{1}{10}$ grain each three times a day after meals, with advantage in some cases. A patient of the writer with aortic disease has found the greatest relief from attacks of severe angina from the barium salt, which he has taken uninterruptedly now for twelve months. He is a person of unusual intelligence, and says that "the pain is there, but is kept in control." To cut short an anginose attack nitro-glycerin is the best remedy.

Pressure, the aim of which is to slow or obstruct the blood-current, and thus bring about coagulation within and obliteration of the sac, in its several means of application so useful in aneurism of peripheral arteries, can obviously render little, if any, service in thoracic aneurism. The writer recalls a case in the Boston City Hospital some years ago in which sheet lead was accurately moulded to the surface of the tumor, the number of sheets being gradually increased. Some diminution in the swelling took place, but absolute rest was simultaneously enforced. Sand- and salt-bags have also been used. Abdominal aneurism has been successfully treated by compression with a tourniquet under an anæsthetic by Murray of Newcastle and others. Woirhage[1] has collected 9 cases thus treated, with 6 good and 3 fatal results. Unfortunately, the most frequent seat of abdominal aneurism is just below the diaphragm, a point at which pressure cannot be applied. Before putting on the tourniquet the bowels should be freed, as far as is possible, from both liquid and gaseous contents; and Murray advises that complete arrest of the circulation through the sac should be aimed at for four hours. If on removing the tourniquet no impression has been produced on the pulsation, the first attempt must be considered at an end; but if the pulsation is somewhat diminished, the instrument should be reapplied for another hour. If the first attempt is unsuccessful after an interval of a few days, pressure should be maintained for six to eight hours; finally, even to twelve. The fatal results have been due to injury to the abdominal viscera, especially the intestines—ecchymosis, rupture, and peritonitis.

Langenbeck reported favorable results from the hypodermic injection of *ergotin* over, or in the neighborhood of, the sac: the method has fallen, doubtless justly, into disuse.

Acupuncture was first practised by Sir E. Home, and of late years by Constantin Paul;[2] it is now used in combination with the galvanic current.

Electrolysis.—The power of the electric current to coagulate albumin not unnaturally suggested its use in the efforts which have been made for years to cure, or at least ameliorate, a malady so intractable as aortic aneurism. It is said to have been tried first by Phillips in England, soon after by Petrequin of Lyons. Both needles have been introduced into the sac, or one alone. That which is connected with the positive pole produces a much firmer clot than that from the negative, and is consequently to be preferred, while the large copper electrode attached to the negative pole is placed at a convenient spot on the surface of the body. The needle should be insulated in such a way that the integument and the true wall of the sac are protected against

[1] Thesis, *Jahresbericht*, 1876. [2] *Bull. de l'Acad. de Méd.*, 1888, xx. p. 224.

the caustic effect of the current. The recommendations as to the strength of current and also the duration of its passage are vague or vary within pretty wide limits. In but very few of the cases does a galvanometer seem to have been used, so that accuracy is not easy of attainment. DeWatteville[1] says the intensity should not exceed 20 to 30 milliampères, nor the duration of the first sitting surpass half an hour. Dujardin-Beaumetz,[2] no longer, according to Potain, as warm an advocate of the method as he was, advised an intensity of current reaching 54 on the Gaiffe galvanometer, and ten minutes as the maximum length of sitting, lest the needle be oxidized and possibly broken on withdrawal. Petit[3] has collected 114 cases of thoracic aneurism treated by electrolysis, with relief in 68. He thinks that his analysis shows a greater probability of relief when the procedure is resorted to before the development of an external tumor. We will not occupy space with a table showing the duration of the improvement attributed to the treatment. That the results are really not encouraging seems to be pretty clearly shown by the fact that comparatively few cases have been reported during the past ten years, by the tone of the discussion at the Medical Society of London,[4] and by the article of Potain.[5]

Still, it is fair to state that there are cases of which two of Richter's[6] may be taken as samples: An engineer of a water company, whose calling involved such severe muscular work as climbing cañons, was treated by electrolysis for a thoracic aneurism in 1884. Four and a half years later, though he still followed his occupation, the original aneurism was well, but a second had developed somewhat higher up. This was treated in the same way, and the patient returned to work. An innominate aneurism in another patient was similarly treated, and also, it is stated, with success; but death followed six and a half months later from tracheal pressure, causing suffocation. Richter thinks that the fatal result was due to a new aneurism, not to extension of the old. It has been remarked that aneurism seems to be common in California.

In comparison with these cases may be cited those mentioned by Bristowe,[7] one patient working for ten, another for three years, with no treatment but occasional rest.

Ralfe[8] claims for galvano-puncture (*a*) prolongation of life in rapidly progressive cases; (*b*) relief of pain, undue pulsation, and paroxysmal cough; (*c*) the probability of an almost painless death,

[1] *Medical Electricity*, N. Y., 1884, p. 200.
[2] *Bull. gen. de Thérapeutique*, 1880, p. 1.
[3] *Progrès Méd.*, 1880, p. 690.
[4] *British Med. Journal*, 1889, ii. p. 1336.
[5] *France Méd.*, June 3, 1890.
[6] *Pacific Med. and Surg. Journal*, May, 1888.
[7] *British Med. Journal*, 1889, ii. p. 1336.
[8] *British Med. Journal*, 1888, ii. p. 1162.

owing to slow oozing from the thickened sac, instead of sudden rupture, which if it occur internally must be extremely painful for a short time.

Others have found the method to be provocative of pain.

Another method of using electricity is that of Galeazzi and Vizioli —the external application of very strong currents, the positive pole on the aneurism, the negative on some indifferent point. The number of cases thus treated is small, but the method would seem to be worthy of further trial, especially as it is apparently free from some of the strong objections which are to be urged against the more radical electrical procedures.

The introduction of foreign bodies into the sac, as a method distinct from acupuncture, was first practised by Moore in 1864. From a few inches to seventy-five yards of metallic wire, watch-spring, horse-hair, catgut, silken or sea-tangle threads, have been passed into aneurisms since then. In 1879, Corradi, and subsequently a few others, extended the method by the addition of galvanism—an addition which does not seem to have proved valuable. In what follows no distinction will be drawn between those cases in which galvanism was used and those in which it was not. There is little or nothing to add to the communication of Verneuil,[1] made to the French Academy of Medicine in 1888. He collected 34 cases in which the operation had been done, subjecting them to a rigid analysis. The conclusions of this eminent authority carry all the more weight in that he is a surgeon, and consequently not prejudiced against operative interference. In 18 of the cases the thoracic, in 4 the abdominal, aorta was the seat of the aneurismal dilatation; in 1 case the arch and innominate, in 1 the subclavian, and in 1 the femoral (*inguinale*) was involved. In 2 cases cure is reported. The more important of these is that of Morse[2] of San Francisco, who cut down on a traumatic aneurism of the abdominal aorta, and then introduced the wire, the patient being discharged from hospital eight weeks later apparently cured. His subsequent history is not known to the writer. The other case of cure was a man of twenty-two with aneurism of the brachial artery, probably easily curable by other means. In many cases the operation was directly fatal. Verneuil acutely observes that apparently imminent external rupture of the sac is a rather weak point on which to base a decision to operate. As a matter of fact, external rupture is a rare exception, and it is well known that cases in which such rupture *seems* imminent often live on for weeks or months, and then die from internal bleeding, or even from exhaustion. He also shows that in some cases, without manifest

[1] *Bull. de l'Acad. de Méd.*, 1888, p. 18.

[2] *Pacific Med. and Surg. Journal*, 1887, xxx. p. 65.

urgency, resort was had to operation before adequate trial was made of milder means. In short, he concludes that the operation under discussion is a failure alike with reference to palliation or to cure, and that its results are far less favorable than those of other surgical, or even medical, methods of treatment. He thinks abdominal aneurism less ill-suited to filipuncture than any other. These utterances of Verneuil were in reply to Lépine, and have been dwelt upon here as based on the largest collection of cases and the most careful analysis.

Macewen's Method.—Macewen[1] has recently reported 4 cases which he has treated by a new method. Under antiseptic precautions a pin tapering to a point like a sewing needle, as fine as is consistent with strength and long enough to transfix the aneurism completely, is passed through the sac until it comes in contact with the other side. The pin is then to be moved over the surface of the inner wall, so as to irritate it, for ten minutes; next another point is to be similarly scratched without removing the pin, and so on until the larger part of the sac-wall opposite the seat of puncture has been acted on in a methodical manner. In some cases puncture from various sides may be necessary. The pin should never remain more than forty-eight hours in the aneurism, and it is questionable whether all the advantages may not be won in a few hours; but its retention for twenty-four to thirty-six hours seems to produce a greater immediate effect. As a rule, distinct thickening of the aneurismal walls follows at an early period, though it may require weeks. The operation is not painful, and should be repeated as often as seems necessary.

The Distal Ligature.—A century ago Brasdor suggested the distal ligature for aneurisms so seated that it is impossible to tie between the heart and sac. As applied to thoracic aneurisms, the operation consists in the ligation of the great trunks arising from the arch, the carotid and subclavian, singly, consecutively, or simultaneously, while the aneurism must be of the ascending or transverse aorta or of the innominate. The sac is still exposed to the blood-pressure, though perhaps to a less degree; but thrombosis may extend backward from the ligature to the sac. Rosenstein[2] and Scheele[3] agree in the opinion that this operation has yielded better results than any other surgical procedure. The former has collected 32 simultaneous operations done since the introduction of antiseptic methods. Of these 14 lived one year or more, during which time they were able to work; 5 were greatly improved; 5 not benefited; and 8 died within a week. Similar but less good results have been won by the consecutive, and even by the single, ligature. Scheele says that sacculated aneurisms of the innominate

[1] *British Med. Journal*, Nov. 15 and 22, 1890.
[2] *Am. Journ. Med. Sciences*, Jan., 1891.
[3] *Therapeutische Monatshefte*, 1888, ii. p. 1.

are those in which the operation is likely to be of service. It may safely be stated as a general law that sacculated aneurisms offer a better chance to treatment of any kind, but the degree of sacculation can rarely be determined with much accuracy. For obvious reasons a traumatic origin renders one more willing to interfere than an origin in syphilis or atheroma.

Manipulation of the sac, as suggested by Sir. W. Ferguson for peripheral aneurisms, and also the injection into the sac of coagulating materials, are not methods which can be recommended for aneurismal tumors of the aorta.

If one can condense the results of the operative and electrical treatment of aortic aneurism into a few words, it must be confessed that they are thus far discouraging, and that the methods do not seem to be growing in favor. It seems questionable whether the successes attributable to these methods are proportionally more numerous or greater than follow simpler treatment. We must remember that some cases do remarkably well with little or no treatment, and that spontaneous cures are not absolutely unknown.

Dissecting aneurisms of the aorta and its main visceral branches are not amenable to any treatment except the administration of opiates.

Diseases of the Veins.

Phlebitis and Periphlebitis.—Inflammation within or about the veins—phlebitis and periphlebitis—is not properly to be discussed apart from venous thrombosis, its concomitant or antecedent. A frequent cause of phlebitis being the extension of neighboring inflammation, the prompt and intelligent treatment of such inflammation is the best prophylactic—early evacuation and skilful subsequent management of abscesses, removal of foreign bodies, etc. Varicose veins are liable to inflammation, and certain individuals, perhaps those of a gouty tendency, seem especially predisposed thereto. Phlebitis is a not uncommon sequel of the severe and long-continued infectious diseases, notably typhoid fever; also of parturition. We recognize, of course, that phlebitis is often an important factor in the healing of wounds, and a barrier against the entrance into the circulation of toxic agents or principles—a danger which is to be guarded against by the strictest possible antiseptic precautions. In the prophylaxis of the other main danger of phlebitis, embolism from the detachment of the clot or a portion thereof, absolute rest is the all-important thing. Until, therefore, the clot in the affected part has become absorbed, or so well organized that there is no risk of its passing into the blood-current, rest is to be maintained while direct pressure on the vein is avoided, and such a position is secured as favors the return of venous blood through collateral channels. The application of moist

heat, the most convenient form of which is the poultice, certainly allays local pain and seems distinctly to promote reparative processes. Friction near the seat of inflammation should be avoided, but may be of service below if applied in the direction of the venous flow. Leeches and ice along the course of the affected vein are said by some to be useful, but the writer has no experience with them in this condition. The bowels are to be kept free. The choice of diet and the administration of stimulants are to be governed with reference to the state and constitution of the patient, rather than to the phlebitis. Pain may be sufficient to demand laudanum locally or an opiate internally.

If the clot is absorbed or the affected vessel is small, the circulation is promptly re-established. But if an important trunk or a considerable number of vessels in the same territory have become impervious, subsequent swelling and more or less disability persist until other channels become adapted to the work. While this process is going on a certain amount of rest is to be preserved, and skilful massage may be of great use. The support afforded by an elastic bandage, preferably of flannel and cut bias, permits greater use of a limb and promotes recovery.

Suppurative phlebitis is a grave condition, and is to be treated locally as a pyæmia, as well as with full diet, stimulants, and tonics.

Varicose Veins.—Unduly *dilated or varicose* veins are most common in the legs, scrotum, and rectum; but may be met with in any portion of the body, in the deeper tissues as well as in and under the skin. Here, again, individual predisposition seems to play an important part, a similar degree of blood-stasis being followed in one person by varix; in another not. There is no doubt, however, that all causes which tend to prevent free venous return from a part tend also to produce varix. Thus an employment which involves standing for long periods, and also tight garters, especially if worn below the knee, are likely to bring out any weakness that may exist in the walls of the veins of the leg; habitual constipation and straining at stool are productive of piles; long-standing portal congestion from whatever cause is followed by fulness of, and often hæmorrhage from, the superior hæmorrhoidal veins; other illustrations will suggest themselves to the reader. Prophylactic measures in any of these directions are in order as far as is possible. The extremes of life are more free from the condition than its middle period. Atony of the surrounding tissues, which thus fail to afford proper support, may also be added as a cause.

The broad principles of treatment of the developing or developed condition are clear and simple. Causes are to be removed as far as may be, though they may have been so long in operation that even after removal their effects persist and admit of only palliative treatment.

Varicosities of the legs may, in their early stages, be cured, much benefited, or, at all events, kept from getting worse, by rest in combination with other methods. If the recumbent position can be maintained for a few weeks, so much the better: if it cannot, as large a measure of rest as possible is to be secured at first. Walking is less deleterious than standing, the muscular contractions favoring the return of blood against gravity. Upward friction and well-applied massage are valuable adjuvants. If exercise is taken or walking is necessary, elastic pressure should be evenly applied before the horizontal position is quitted, and not left off until the legs are again raised to the level of the body. Circumstances must determine whether the pressure is to be obtained from an elastic stocking, from a rubber bandage, or from a flannel bandage cut bias. The pure-rubber bandage is a somewhat dangerous thing to put in the hands of a patient, who is apt to apply it too tightly and thus obstruct the circulation. When it is used a layer of cotton batting should intervene between the bandage and the skin, in order that moisture may be absorbed and maceration of the skin prevented. The general condition of the patient should receive careful attention, the diet being made more or less generous, and stimulants being given or withheld according to the requirements of the particular case. The bowels are to be regulated, in free livers at least, preferably by salines. In cases of marked local varix a pad of cotton or lint may be firmly fixed by strapping with adhesive plaster. Rupture of a vein, sometimes proving fatal from loss of blood, the patient being, perhaps, far from medical or skilled attention, requires local pressure and elevation of the limb.

The cases in which a cure is effected by the foregoing methods are not numerous. Many people go about without any mechanical support, but with a considerable degree of varix, and suffer little or not at all for a long time; or they may have more or less weariness or pain, generally dull, in the legs. The condition is, however, apt to get worse more rapidly when thus let alone. The palliative treatment is troublesome and must be persisted in for years; but sufferers become gradually accustomed to this as to many other chronic ailments, and do not very often demand an operation for radical cure. The use of caustics with the aim of producing inflammation and obliteration of the dilated trunk is now obsolete. Another and better means of securing the same end is by passing needles behind the vein, and then winding silk, rubber, or wire about them. Subcutaneous ligature of the vein is well spoken of, and excision of a portion of the vein has also given good results. For details as to these and other strictly surgical modes of radical cure the reader is referred to standard surgical works.

The treatment of hæmorrhoids is considered in the article on Diseases of the Rectum and Anus, Vol. II. of this System.

Raynaud's Disease.

Vascular spasm is supposed to be the immediate cause of this affection, which is therefore classified here under diseases of the blood-vessels. The cause of the spasm is in most cases extremely obscure, and we are obliged to content ourselves with attributing it to idiosyncrasy. Malaria seems to be influential in some cases. Syphilis has also been thought to be a cause; but this disease would seem much more likely to produce impairment of the circulation through arteritis than through spasm. The relations of Raynaud's disease to hæmoglobinuria are of greater therapeutic interest than are its relations to scleroderma and peripheral neuritis: indeed, gangrene is the only feature of Raynaud's disease which can well be brought into close connection with neuritis. Cold and dampness are of etiological importance in some cases, as is shown by the fact that the affection is more apt to originate in the winter and spring. But it does not always do so, and Raynaud[1] speaks of a Central American gentleman who came to Paris for treatment without obtaining relief. The same observer notes that attacks do not come on while the patient is in bed.

It is not in our power at present to prevent the disease, but something can be done to ward off the attacks in those known to be predisposed, by avoidance of chill and by warm clothing. Persistent galvanism and friction are also probably of value, and Barlow[2] relates a case in which the disease was kept in abeyance for two years by this means. Finally, the patient became weary of the treatment and abandoned it; severe gangrene followed by lymphangitis set in, and it was necessary to amputate the thigh. If attacks are repeated at short intervals, there is hope that by remaining in bed the liability may be overcome, at least for a time. Unfortunately, the disease seems to affect by preference classes of the community, feeble women and children in poor circumstances, who are unable to follow out prophylactic measures to the full. Between attacks patients should exercise in suitable weather as much as they can.

In the treatment of an attack it is our aim to try to restore free circulation as quickly as possible, thus alleviating the pain, which may be very severe, though it is sometimes absent, and diminishing the danger of consecutive gangrene. In mild cases it may be sufficient to wrap the part in cotton and place it near the fire. If tenderness is not too great, friction is to be used, but is not tolerated in the earlier stages of severe cases. In such, warm applications and galvanism are the best remedies. It is true that Southey found an ice-bag more grateful than warmth in one of his cases, but Raynaud has seen painful recru-

[1] *Selected Monographs*, New Sydenham Society, 1888.
[2] *Ibid.*; also *Illustrated Medical News*, April and May, 1889.

descence after the cessation of cold irrigation. He also warns us against the use of such a decided rubefacient as mustard.

Galvanism was first used to the spine by Raynaud, with the idea of acting on the vaso-motor centres, but it is found that direct application to the limbs is more efficacious. Barlow advises immersion of the affected limb in salt and water with one pole of the battery, while the other pole is moved about on the skin above the level of the water. "The current should be rapidly reversed, made, and broken, and the patient should be encouraged to make voluntary flexion and extension movements of the limb during the time it is being galvanized." A change in hue from purple to pink shows that restoration is taking place, and galvanism should be kept up till this change is complete: friction can then generally be borne, and the patient should be urged to practise this himself. Another method of applying galvanism is by "painting" the limb with the current, the poles being placed quite near each other. Lamp, vapor, and Turkish baths are also recommended. The occurrence of limited gangrene should not prevent a continuance of electricity above the affected area.

Mild cases of gangrene can safely be left to themselves, but major degrees may demand surgical interference—even amputation when the deeper tissues are seriously involved.

Internal medication has thus far proved nearly valueless in this disease, if we may except opiates for the relief of pain. A sufficiency of good food is important, and it may be desirable to give such remedies as tend to promote appetite and digestion, and also general tonics. The apparent close connection with vascular spasm naturally suggests the use of the nitrites, which have been repeatedly pushed to the point of headache and flushing of the face without producing the slightest change in the affected parts.

DISEASES OF THE BLOOD.

By FREDERICK C. SHATTUCK, M. D.

Anæmia.

Some consideration of etiology must necessarily precede the attempt to describe the treatment of any affection—a statement which is particularly true of anæmia, so common and widespread in its several forms, so often merely a symptom or result of some underlying local or general cause.

Our knowledge is not yet sufficient to enable us to make a perfectly satisfactory classification of the causes of anæmia. Perhaps that which is usually employed for clinical purposes is as good as any—into the two great divisions, namely, of primary and secondary anæmias. With increasing knowledge the primary class is likely to grow smaller, but it includes all those anæmias dependent on a cause or causes, to us unknown, acting directly on the blood itself, on the blood-forming organs, or on both at once. We have no right, therefore, to class an anæmia as primary until we have carefully excluded all causes, whether local or general in character, to which the condition may reasonably be attributed.

It is more convenient to take up the secondary anæmias first, and to set forth their most frequent causes, although it is true that in these cases we must sometimes treat the anæmia symptomatically, either because the cause is wholly or partly irremovable or in recognition of the well-known facts that disease often works in a circle, and that, in biology at least, the effect does not always disappear on the removal of the cause.

Secondary Anæmia.—Among the chief causes of anæmia are the following:

1. *Hæmorrhage.*—Hæmorrhage whether single and profuse, or more or less trifling, but persistent. Obviously, the indication is to arrest the blood-loss, success in meeting which will ordinarily be followed by a rapid restoration, first, of the plasma, somewhat less promptly of the red corpuscles. Either class of hæmorrhage may, however, in rare cases apparently produce such an effect on the blood-forming organs themselves that they are unable to make good the loss.

The feeble cardiac action on which syncope indirectly depends may

bring about cessation of a profuse hæmorrhage, and circumstances must then determine whether it is desirable to do more than secure absolute rest, with such precautions against the recurrence of the bleeding as its nature and seat suggest. It is estimated that a person can stand a single blood-loss of at least a third of its total volume without a directly fatal result, perhaps with a surprisingly rapid recovery. If the patient does not show signs of rallying from the collapse following hæmorrhage the question naturally arises of artificially supplying in greater or less measure the loss sustained. A simple and ready means of stimulating the circulation is the application of heat internally by a rectal injection of a quart of warm saline solution, externally by hot bottles, some form of alcohol being given by the mouth if the patient can swallow. Or a sterilized solution of common salt, 0.6 or 0.7 per cent., can be thrown into a vein, into the subcutaneous tissue, or into the peritoneum. It has been and is maintained by some that such a saline solution is just as potent to save life as is the transfusion of pure or defibrinated blood, while it is free from some dangers incident to the latter procedure. Landois[1] and others, however, hold that the most which a saline solution can do is somewhat to delay death, basing their conclusions partly on general principles, but chiefly on the results of experiments on animals. Such cases as that of Whitwell[2] of San Francisco, who apparently saved the life of a typhoid patient collapsed from intestinal hæmorrhage by the transfusion of whole blood after a saline solution had been injected into a vein without success, seem to bear out this view. But there are other and more numerous cases recorded in which the saline solution seemed certainly to save life, though it is possible to assert in these that recovery would have ensued without its use. The last word has probably not been said as yet on this question.

Transfusion of blood may be made either directly or indirectly. In the former case it is most easily done with the aid of an Aveling syringe, which consists of a rubber tube having a small bulb in the centre, and with metallic extremities fitted with stopcocks. A canula or hollow needle is to be attached to either end. The arms of the patient and the giver of the blood are placed side by side, and at the same time that the surgeon opens the most prominent vein in the patient's elbow an assistant opens one in that of the giver. The canulas, previously filled with water, are introduced, the point in the former being directed toward the body, in the latter toward the hand, and connected by means of the syringe, which is filled with tepid water or a weak salt solution to displace the air, and the stopcock closed. The cock on the patient's side is then opened, and the contents of the bulb

[1] Eulenburg's *Real Encyclopædia*, vol. xx. 2d ed., Article "Transfusion."

[2] *Pacific Med. and Surg. Journal*, April, 1886.

slowly injected. The bulb is refilled by closing the cock on the side of the patient and opening that on the side of the donor, and the process is repeated till enough has been introduced, when the cannlas are removed and the wounds dressed as after venesection. The chief dangers to be avoided are sepsis and the introduction of air.

In mediate transfusion several methods have been employed: in one the donor is bled directly into a syringe, the piston being withdrawn; the piston is then replaced and the blood injected into the patient's vein. Rapidity of execution is essential to prevent coagulation, and not more than two minutes should elapse between the receiving and delivery of the blood. For intravenous injections of defibrinated blood, or a 0.5 or 0.6 per cent. solution of salt, all the apparatus required consists of a glass funnel, some rubber tubing, and a cannla, the rapidity of the flow being regulated by raising or lowering the funnel. According to Mayet,[1] if the median basilic be selected, the amount should be about an ounce per minute, though not much harm is likely to arise if ten ounces be injected in six minutes; and this should generally be the maximum quantity except in cases of extreme urgency, in which the relative emptiness of the vessels is the chief source of danger. The same simple apparatus is also sufficient for the subcutaneous injection of salt solution: from 500 to 1000 c.c. (17 to 33 ounces) may be injected beneath the skin of the back or the axillary region, absorption being aided by gentle massage. Should the skin become too greatly distended, a second injection can be made. This method of rapidly making up a deficiency in the quantity of the circulating liquid is free from danger, can be easily done without trained assistance, and in many cases in practice has been successful.

Ziemssen has largely practised another method which seems to be at least safe—namely, the subcutaneous injection of defibrinated human blood. His first results were not satisfactory, but after an interval of nearly ten years he has lately resumed his work in this line, and has now so perfected his technique as to avoid all undesirable effects and obtain marked benefit. Strict antiseptic precautions are observed throughout the operations of drawing and injecting the blood, which is done under the skin of the thighs. He uses a syringe containing 25 c.c. (6.7 drachms), the contents of which are thrown slowly into the tissue, while an assistant puts his "full strength" into massage of the part, so that the blood is diffused widely and thus put into a favorable condition for rapid absorption. From six to fourteen syringefuls are injected at a sitting, the patient being under anæsthesia, as the injection and the massage are alike painful. If no more than 50 to 100 c.c. (1.6 to 3.3 ounces) is injected,

[1] *Lyon Méd.*, May 10, 17, and 24, 1891.

the patient can leave his bed the next day; if larger quantities, the soreness is likely to keep him quiet five or six days. In cases of great urgency a salt solution should first be injected into a vein, thus furnishing the heart bulk on which to act until the corpuscles contained in the subcutaneous blood injection can reach the circulation and supply that which is needed for permanent recovery. An obvious objection to this method in urgent cases is the necessity for anæsthesia.

2. *Loss of the Albuminous Constituents of the Blood.*—Anæmia which is dependent on loss of the albuminous constituents of the blood, as in lactation, Bright's disease, prolonged or profuse suppuration, watery diarrhœa, and the like, may often be treated symptomatically with advantage, but we must strike deeper if we hope to accomplish notable or lasting results.

3. *Inanition.*—A large class of anæmias is attributable to *inanition*, dependent on a single, or a combination of many, causes. Among these may be mentioned defective hygiene in one or many elements —unfavorable surroundings; insufficient or inappropriate food; and lack of power, from local or general causes, to take or assimilate food, however suitable or easily attainable. In this class are included all those numerous cases of gastric disorder in its many and varied forms. These causes are rarely single, but are met in every variety of combination; each class in life, each occupation or trade, each sex, and the different periods of life involving more or less peculiar liabilities to innutrition anæmia. There would be no difficulty in filling pages of this work with illustrations of these causes in detail, were it necessary or desirable to do so. Of course it is often quite impossible to remove the single or combined causes. Fortunately, however, man is a wonderfully adaptable animal, and manages to accustom his organism to very unnatural, even to deleterious, influences. The breaking up of some bad habit—masturbation, excess in tea, coffee, or tobacco, insufficient sleep—the intelligent treatment of impaired digestive power, or a change of dwelling-place may be followed by recovery though the mode of life of the patient is still far from ideal in many other respects. A word should be said as to the association of atrophy of the gastric tubules with grave anæmia. We know that the two are sometimes coincident, but it is not clear that the tubular atrophy is primary. We have been led to believe in recent years that the importance of the stomach is less paramount for digestion than was formerly thought, and that intestinal digestion may be sufficient to maintain life for long periods.

4. *Toxæmia.*—The toxic anæmias fall into two subdivisions: first, those in which the continued absorption of a mineral poison is the causative agent, lead, mercury, arsenic, and phosphorus being specially referred to here. In potassium iodide we possess a valuable means of

freeing the lead stored up in the tissues in an insoluble form. The dose should not exceed 10 grains thrice daily, and J. J. Putnam, who has given much attention to plumbism, particularly in its nervous manifestations, and to its treatment, believes that the drug acts better when given for a few weeks, omitted for a like period, and so on. There is thought to be danger of producing cerebral symptoms if large doses are given at first and relatively considerable quantities of lead are thus poured out rapidly into the circulation. Warm baths and laxatives are held to be promotive of the elimination of the metal. Essentially the same means are recommended for the expulsion of mercury as for lead. It is not probable that we can directly influence the elimination of arsenic and phosphorus.

The second sub-class of toxic anæmias includes those dependent on syphilis, malaria, intestinal parasites, and perhaps myxœdema: if the view of Sir Andrew Clark is correct, his fæcal anæmia also belongs here, constipation favoring in some persons the development of principles in the alimentary canal which, by being absorbed into the blood, act deleteriously on that tissue itself or on the organs which play the chief parts in its formation. The anæmia of syphilis and malaria demands general tonics and change of air in addition to the specific treatment appropriate to each of these diseases. It should be firmly fixed in the mind that direct antisyphilitic remedies alone often fail, but succeed when combined with measures skilfully addressed to the general state.

Griesinger showed the dependence of Egyptian chlorosis on the anchylostomum, but it is only in recent times that the attention of the profession outside the tropics has been strongly directed to intestinal parasites—the tape-worm, especially the *Bothriocephalus latus*, the *Tricocephalus dispar*, and, above all, the *Anchylostomum duodenale*—as causative of anæmia. The outbreak of anchylostomiasis among the workmen of the St. Gothard tunnel, at first deemed a peculiar anæmia, aroused great interest. Cases bearing all the marks of that form of anæmia called pernicious have been repeatedly cured by the expulsion of a tape-worm. Kynsey[1] shows that the beri-beri of Ceylon, which is never followed by paralysis, is really a secondary anæmia traceable to the anchylostomum. Erni[2] in upward of fifty autopsies on beri-beri patients in Sumatra has never failed to find the lesions of the tricocephalus or the anchylostomum, which, he says, are not found in patients dead from other diseases. There is doubtless here an important field for further study, and it is certainly desirable to remember that intestinal parasites, either by the abstraction of blood or through the absorption of some ptomaïnes, the formation of which is

[1] *Report on Anæmia, or Beri-Beri, of Ceylon*, Columbo, 1887.

[2] See p. 53 of Kynsey's *Monograph*.

or may be a concomitant of their life in the body, may be at the bottom of an anæmia which proves rebellious to ordinary treatment.

The eggs of the parasites should be carefully searched for in the stools of such a patient. If these are found, the species of worm is then known as well as the particular anthelmintic which should be administered. The examination of fæces is not, however, an attractive field in which assistants delight to wander; and one should not, therefore, rely implicitly on a negative report in obstinate cases: a series of anthelmintics can do no harm if properly given, and may complete the diagnosis and cure the patient at one and the same time.

The fæcal anæmia of Clark reminds us of the long-standing use of laxatives in anæmia and of the statement made, I believe, by Hamilton of Dublin long ago, that were he compelled to choose between chalybeates and laxatives in the treatment of anæmia, he would select the latter. The discovery of ptomaïnes and leucomaïnes seems to give justification for the faith which was in many, and has also thrown important light on the function of that large and mysterious organ, the liver, which stands between that portion of the body where putrefactive change is normally going on and the general circulation, and is charged with the duty of splitting up the toxic agents formed in the intestines, absorbed into and passed along the portal system.

The anæmia which often accompanies or follows the acute infectious diseases, as well as such chronic affections as tuberculosis and cancer, is probably of mixed origin in most cases, inanition, hæmorrhage, changes in the plasma, and toxæmia being factors in varying degrees in different cases. Careless practitioners sometimes find out when it is too late for their own reputations, as well as for the interests of their patient, that an anæmia which is guessed by them to be simple was really underlain by tubercle or cancer.

Primary Anæmia.—We are now come to the consideration of those anæmias which for the present we must remain content to class as *primary* (having first excluded all probable causes external or internal to the individual affected), and the treatment of which must therefore be symptomatic rather than causal. For clinical purposes we can distinguish three forms of primary anæmia: 1st, simple anæmia, 2d, chlorosis, 3d, pernicious anæmia.

1. *Simple Anæmia.*—Anæmia is to be prevented by a life of "hygienic righteousness," to use the expression of the late Dr. George Derby of Boston. Such a life is, however, obnoxious to most of us, and we prefer to take our chances, believing, as often proves true, that there will be time for repentence and reform before irremediable damage is done. The cases in which we have, perhaps, the best opportunity for preventive treatment are those of delicate

children, the rearing of whom should be intelligently supervised, especially if they come of families predisposed to anæmia, phthisis, etc. A country life, with a change to the seashore during a portion of the year, or *vice versa;* proper sleep and food; suitable clothing; bathing with water at as low a temperature as permits prompt and lasting reaction; such an amount of exercise, and no more, as trial shows to be well tolerated,—these are some of the important things to be secured. It may be found that the stimulant action of cold water on the skin can be gained in the following, if in no simpler way: On rising the skin is to be rubbed with a dry and roughish towel—the hand of the nurse may be used for a child; a cup of hot nourishment is then to be taken; next, the person sits in the tub with a few inches of warm water and dashes or has another dash a large pitcher or pail of water at about 60° Fahr. on the neck, and is then vigorously rubbed dry. This is a plan recommended by Dr. Eustace Smith, and has been found by the writer to act well. The wisdom of the parent counts for as much as the skill of the physician. In children of both sexes masturbation is often overlooked, it being taken for granted that a child is too young for such practices, or it being thought undesirable to "put ideas into its head." The writer's experience inclines him to believe that the profession would do well to call the attention of parents to this danger more frequently than is done.

A deficient appetite or feeble digestion must be stimulated or reinforced in accordance with well-known principles, into which we cannot enter here in detail. The Weir-Mitchell plan of treatment is especially adapted to those cases in which nervous exhaustion is an accompaniment of anæmia. Massage and electricity without seclusion and forced feeding, or various combinations of these methods, may be sometimes employed with advantage.

The drug which general professional experience has shown to be of perhaps most service in simple anæmia is iron. Some experimenters tell us that the amount of iron which is absorbed into the blood is infinitesimal. Hamburger,[1] for instance, recovered from the fæces of dogs nearly all the iron administered to them by the mouth. That this result is not to be explained by the excretion into the intestine of the iron after absorption into and circulation with the blood seems to be shown by the experiments of Jacobi,[2] who injected iron into the blood-vessels of dogs and rabbits. He found that about 10 per cent. is excreted by the bowels, liver, and kidneys together; about 50 per cent. is deposited in the liver; the rest in the spleen, kidneys, intestinal walls, and other organs: it is all removed

[1] *Zeitschrift für Phys. Chemie*, 79 and 80.

[2] *Arch. für Experimentelle Path.*, xxviii., 1891.

from the blood within two or three hours after administration. The foregoing investigations were made since the publication of the seventh edition of Wood's *Therapeutics*,[1] in which a foot-note states "The subject of the absorption of iron urgently needs reinvestigation." The note might stand unchanged to-day. Exactly how iron acts we do not know, but we do know that it is an important constituent of hæmoglobin, and we have the strongest clinical evidences of its usefulness in anæmia, especially in those cases in which the hæmoglobin is relatively more diminished than the number of red corpuscles—chlorosis.

There is no one preparation of iron which meets all cases equally well, and it is fortunate that we have a large number of pharmaceutical compounds and natural mineral waters from which to select. The latter may be dismissed with the statement that the great advantage of drinking them at their sources lies in the more easy enforcement of general hygiene: the intrinsic merit which they possess is the dilution of the metal, and its consequent greater acceptability to some stomachs. A coated tongue with feeble digestion and constipation are held, and generally justly, to be contraindications to the use of iron, the way for which must then be prepared by the vegetable bitters, mineral acids, pepsin, and laxatives. Orexin hydrochlorate has been recently recommended by Penzoldt[2] as a stimulant to the appetite and digestion in early cases of phthisis, chlorosis, and anæmic conditions. It is to be given in doses of from 5 to 10 grains, either in dilute aqueous solution or in pills. Müller[3] has not found it useful, but Gordon[4] speaks highly of its effects in scrofulous children. Most ferruginous preparations are more or less constipating, and it is therefore often desirable to combine the iron with a laxative—aloes, for instance—or to give the latter separately. There seems to be some doubt whether the proto- or the per- salts are the more readily absorbed, but it is not likely that solubility of a salt in water offers any advantage, the acid gastric juice precipitating most of the metal. It is stated that large doses of iron are less constipating than small ones, in that the former stimulate peristalsis. It does not seem worth while to enumerate or discuss the merits of the different preparations: each practitioner has his favorite or favorites. Perhaps the tincture of the chloride is more used than any other liquid form of iron; the sulphate, carbonate, and citrate than any other solid preparations. It is better to give too much than too little, especially if the large doses are less constipating.

The hypodermic injection of soluble iron preparations, of which the lactate, the salicylate, the albuminate, and the double citrate of iron and ammonia are the least irritating, has been practised by some. The only experience the writer has with this method is in one case of per-

[1] P. 474.

[2] *Therapeutische Monatshefte*, 1890.

[3] *Ibid.*, later No.

[4] *Lancet*, 1891, ii. p. 68.

nicious anæmia with great gastric irritability. It is true that iron does not usually prove useful in these cases, but other remedies failed, and dialyzed iron was injected. No abscesses were formed, but at the autopsy so much iron was found in indurated lumps at the site of the injections that it would seem that little if any could have been absorbed.

Arsenic is a remedy of great power, and can be given alone or in combination with iron. Manganese is believed by some to be useful. The phosphate of lime, usually given now-a-days in the form of the compound syrup of the hypophosphites of lime, sodium, and potassium, with or without the addition of iron, quinine, and strychnine, is much given, and is probably especially useful in the anæmias of the period of active growth, of lactation, and the like. Cod-liver oil, if well borne by the stomach, is very useful in scrofulous and some other anæmias; and the favorite form of iron in these cases is the iodide. A mixture of the syrup of the iodide of iron and cod-liver oil is an inelegant mess, but commends itself to many dispensary patients.

Anæmia being associated with deficient oxidation, due partly, no doubt, to diminution in the number of red corpuscles, as well as in the hæmoglobin, it is natural that one should think of the possibility of artificially supplying oxygen by means of inhalation or by the drinking of distilled water saturated with the gas. With regard to the usefulness of oxygen inhalations there has been and is much dispute among physiologists and clinicians alike. One party denies the possibility of adding to the oxygen of the blood by any such means, which, at the most, is nothing more than pulmonary gymnastics: among these may be mentioned Ewald[1] and G. L. Peabody.[2] A second party maintains the exact opposite, its members differing only in the degree of value which they attach to the inhalations: this side is well presented by Ephraim.[3] Aune[4] is satisfied that he has observed increase both in the number of red corpuscles and in hæmoglobin in healthy persons. Hayem[5] is convinced that oxygen inhalations improve the appetite, digestion, and general condition of chlorotics, increasing the number of red cells, but not the hæmoglobin, and rendering it possible in many cases to give and derive benefit from iron, which without the oxygen may not be tolerated. The effect of the inhalations alone he finds temporary, patients falling back when they are discontinued. The value of oxygen, therefore, in his opinion, is as an adjuvant to other treatment: Doreau[6] shares his view. Albrecht,[7] as a result of his experi-

[1] *Handbuch der Allg. und Spec. Arzneiverordnungslehre*, Berlin, 1887.
[2] *Med. News*, May 25, 1889.
[3] "*Ueber Sauerstoff—Therapie*," *Berliner Klinik*, Feb., 1890.
[4] *Thèse de Paris*, 1880.
[5] *Gazette de Paris*, 1881, p. 21.
[6] *Thèse de Paris*, 1881: Virchow. Hirsch, *Jahresbericht*, 1881.
[7] *Jahrbuch für Kinderheilkunde*, N. F. Bd. 18.

ence with fifty convalescent but anæmic children, believes that oxygen increases both corpuscular richness and hæmoglobin, improving at the same time appetite and digestion: he says nothing to indicate that these good effects were only temporary. Jaccoud[1] and Dujardin-Beaumetz[2] are also among the adherents of the use of oxygen in anæmia. A third party preserves a cautious neutrality, not denying the possibility of usefulness, but holding it to be doubtful or very slight. Among its members may be named Nothnagel and Rossbach,[3] and Oertel.[4]

Perhaps this oxygen controversy affords as fair an illustration as any of the difficulties which are often met in approaching a therapeutic question from the physiological and experimental side. Experimental evidence must be very strong to warrant us in absolutely throwing over clinical evidence: there is plenty of room for error in both. Practically, however, the number of cases of simple anæmia and chlorosis in which it is clearly our duty to resort to oxygen are few, inasmuch as we can generally gain our ends sufficiently well without its aid. Until the price of the gas is less than at present, its costliness alone must debar its use in many cases. The gas would seem indicated in cases of anæmia and chlorosis which prove rebellious to the more common methods, and in which for any reason it is impossible to secure an abundance of pure country or sea air. It is probably not a matter of much consequence whether the pure gas or that mixed with nitrous oxide is used: a smaller quantity than ten gallons three times a day is not likely to render much service. Oxygen has also been administered by enema.

Transfusion and its substitutes, which were spoken of under the head of acute anæmia from hæmorrhage, are seldom demanded in simple anæmia and chlorosis, though they have been practised. Ziemssen's method is the best—or least undesirable—of these, and he reports that in a girl of eight years the hæmoglobin nearly doubled within twenty-four hours after the subcutaneous injection of 50 c.c. (1.6 ounces). Blood-drinking in slaughter-houses has now gone out of fashion. Pastilles of hæmoglobin do not seem to have won general favor.

Boerhaave and Hoffman held that chlorosis is really a condition of plethora, and Emmerich was thus led, in a thesis published in 1731, to advocate repeated small venesections for its cure. This treatment has been revived by Scholz[5] of Bremen, who holds that the high arterial

[1] *La Semaine méd.*, Aug. 3, 1888.

[2] *Leçons de Clinique Thér.*, iii. p. 406.

[3] *Handbuch der Arzneimittellehre*, Berlin, 5 Auflage.

[4] *Handbuch der Respirat. Therapie*, Leipzig, 1882.

[5] *Die Behandlung der Bleichsucht mit Schwitzbädern und Aderlässen*, Leipzig, 1890.

tension long recognized as present in many cases of anæmia and chlorosis is primary, the changes in the cells and hæmoglobin secondary. In his earlier experience he combated the high tension by hot baths with gentle friction, and met with such success that he has persevered in this line of treatment. Of late years he has gone a step farther, supplementing the hot baths by venesection, and is satisfied with his results. Faye[1] reports two cases, one his wife, in which repeated small bleedings were successful. Wilhelmi[2] reports thirty cases of severe anæmia—some of which had failed to improve under iron and other drugs—successfully treated in this manner.

Enemata of fresh or dried defibrinated blood, the use of which was advocated by A. H. Smith,[3] are probably no more useful than nutrient enemata of other and more accessible ingredients; but there can be no question that the rectum may be forced into service with advantage in severe cases, particularly those in which gastric digestion is greatly enfeebled.

Chlorosis.—With regard to the treatment of chlorosis there is not much to add to what has been already said. Chlorosis, in its pure form, is practically peculiar to young females, and is furthermore distinguished from simple anæmia in that the number of the red corpuscles remains about normal, while the hæmoglobin is greatly diminished, the blood of anæmia showing decrease in both directions. If both are diminished, but the hæmoglobin in excess, the two conditions are said to be combined; and combined they not infrequently are. It is in chlorosis that iron scores its most brilliant successes, and it is gratifying to follow with the hæmometer the rapid increase in the hæmoglobin under the use of the drug, which should be given in large doses and continued for two months or more in combination with the best attainable hygienic measures. If Virchow's view as to the etiology of chlorosis were true, it is difficult to understand how the condition can be so transitory and curable as it generally proves. The arterial system can scarcely become deficient and again sufficient within relatively brief periods of time.

From what has been said above, the practical use of hæmoglobin estimations, as suggesting how far iron is indicated in any particular case, is obvious. Amenorrhœa is vastly more likely to be a result of anæmia and chlorosis than to stand in any causative relation thereto. As the blood and general nutrition improve, the menses reappear, and gradually regain their normal amount and character.

Pernicious Anæmia.—As the name indicates, pernicious cases do not hold out hopes of brilliant therapeutic success. And yet some cases which seem to be primary do recover: the prognosis is there-

[1] *Norsk. Mag. for Laegevidenskaben*, 1887, p. 821.
[2] *Berlin. klin. Wochen.*, 1891, No. 9. [3] N. Y. *Med. Record*, July 18, 1878.

fore, though grave enough, less so than it was in the early days of our knowledge of this disease. Other cases improve very markedly for a time, perhaps apparently recover, but relapse and ultimately succumb. Some of the reported recoveries are surely illusory, and, if they had been longer followed up, would not have been classed as such.

In pernicious anæmia the percentage of decrease in the number of red corpuscles is ordinarily greater than that of the hæmoglobin, though the latter may fall as low as 20 per cent. The studies of Hunter and others afford ground for the belief that, certainly in some cases, the root of the trouble lies in increased blood-destruction rather than in deficient formation: indeed, it would seem that blood-formation may be unusually active, even in strongly-marked cases.

The cause of the affection being either unknown or beyond our reach, treatment must be practically symptomatic, with the general aim of restoring a true balance between hæmogenesis and hæmolysis, as far as possible. Hospital treatment is desirable for those of small or very moderate means, as in no other way can they obtain the minute attention to nutrition and the amount of attendance which they require. In a few cases change of air has proved beneficial, but ordinarily, if fair hygienic surroundings are obtainable at home, that is the best place. The stimulus to nutrition afforded by fresh air and sunshine is of great value. Keep the windows open and the shades up, therefore, as much as possible, remembering only that the circulation is apt to be feeble and to require the aid of hot bottles and plenty of blankets. Absolute rest is also of great importance, and the maximum amount of food should be given by the stomach and bowel. If notable diarrhœa or gastric irritability are features of the case, the problem of feeding is more difficult and the outlook more grave. Hunter[1] has seen gain appear first after the adoption of an exclusively farinaceous diet, and thinks that this may prove a valuable hint. A nitrogenous diet, according to him, causes in health much greater blood-destruction than a farinaceous one, probably from more readily leading to putrefactive changes in the intestine, which changes he thinks are perhaps the causative agent in the production of the increased blood-destruction characteristic of pernicious anæmia. The writer has for some years fed his cases of this kind with beef-juice, eggs, and milk to the limit of toleration of both stomach and rectum: he has seen no permanent recovery, though repeatedly very great temporary improvement.

Iron is less valuable than arsenic in this disease, though the combination of the two sometimes works better than the latter alone. Arsenic should be given at first in small doses, gradually increased toward the limit of toleration, and kept up for a long time after conva-

[1] *British Med. Journal*, July 5 and 12, 1890.

lescence seems to be established. In the case of a boy for a long time under the writer's care in the Massachusetts General Hospital last winter, a few drops of Fowler's solution after meals were soon followed by distinct general loss and fresh hæmorrhages: this occurred twice, and suggested the possibility that chronic arsenical poisoning might be the cause of his anæmia. But the urine contained no arsenic after that which was given him medicinally was eliminated. The only thing which seemed really to benefit this boy was the inhalation of oxygen, ten gallons thrice daily. The writer has in another case seen the number of red corpuscles and the hæmoglobin rise nearly to the normal from a very low point, with corresponding gain in the general condition under oxygen, for some time previous to the use of which the patient was steadily losing ground in spite of what seemed the best treatment. Later, relapse set in, and oxygen then failed to stay the downward trend.

The hope of benefit from transfusion and its substitutes must be extremely small. Arterial transfusion is said to have been successful in the experience of Quincke in one case.

Leucocythæmia.

The treatment of this disease is less hopeful than that of pernicious anæmia, certainly when it is sufficiently advanced to warrant a positive diagnosis. The etiology is very far from clear. Eichhorst[1] gives a list of widely-differing ailments which have been followed by leucocythæmia, and it is maintained by some that affections leading to chronic hyperplasia of the spleen and lymph-glands, as well as changes in the bone-marrow, are predisposing causes. If this be so, the prompt and thorough treatment of these conditions has prophylactic value. Osler[2] is inclined to think that chronic splenic tumor is more likely to be followed by anæmia than by great increase in the number of the white corpuscles. At all events, we are not acting against the interest of a patient with a malarial spleen if we do our best to cure him with quinine, arsenic, or other antiperiodics.

Mosler and some others report recovery under quinine, arsenic, iron, and other tonics in what they take to be the early stage of the disease —moderate splenic enlargement and increase in the leucocytes, with little or no involvement of the lymph-glands. Cold douches, faradization, galvanism, and inunction of biniodide of mercury ointment over the enlarged spleen have all been used in the hope of reducing its size, and thus combating the disease: it is more clear that the first result may be obtained than the second. The spleen has been excised a number of times, oftener than is likely to be done in the future if statistics

[1] *Handbuch der Speciellen Path. und Therapie.*

[2] Pepper's *System of Medicine*, vol. iii.

have any value. Injections of ergotin, iodine, Fowler's solution, etc. into the spleen and glands do not kill patients, but are not apparently useful.

Arsenic, phosphorus, iron, quinine, and general tonic and symptomatic remedies are those which, administered internally, seem to have yielded the best results. It must be remembered that oscillations in the number of the white cells and in the size of the tumors occur quite independently of treatment in some cases. Caution is to be exercised in the use of laxatives, in view of the troublesome diarrhœa which is sometimes a prominent symptom. Marked gain in all respects has promptly set in after oxygen inhalations. DaCosta[1] has given a hundred gallons daily.

Even in a work of the size of this it seems hardly worth while, merely for the sake of completeness, to enumerate all the unsuccessful therapeutic efforts which can be found in literature.

Pseudo-leucocythæmia.

The etiology of Hodgkin's disease is too obscure to give us any prophylactic hints, unless the first glandular swelling may originate in some long-standing irritation in the neighborhood. We know that in some cases the lymphadenomatous growth is pretty strictly limited to one, and perhaps an accessible, group of glands. Here it is probably our duty to call in the aid of the surgeon after a fair trial of medical treatment. But surgery is powerless if the disease has become generalized, except to relieve impending suffocation from pressure on the upper trachea. Local treatment of the glandular tumors, whether by inunction, injection, electricity, or other means, seems to be devoid of real value.

We are therefore limited in most cases to a symptomatic and general tonic treatment. At the head of the list of internal remedies arsenic should probably be placed. As in leucocythæmia, it should be begun in small doses, which are to be increased up to the limit of toleration, and there maintained for weeks or months. Phosphorus is said to have proved useful: there is no objection to trying the iodides and cod-liver oil. Spontaneous changes, similar to those observed in leucocythæmia, also occur here.

Melanæmia.

This condition occurs only in connection with chronic malarial poisoning, extensive melano-sarcoma, and, rarely, Addison's disease. The former demands energetic appropriate treatment; the two latter are beyond the reach of remedies.

[1] *Am. Journ. Med. Sciences*, 1889.

Hæmoglobinæmia.

Whenever destructive action is exerted on the red blood-corpuscles, more or less of their hæmoglobin is set free, and mild degrees of hæmoglobinæmia thus probably accompany many cases of the different forms of primary and secondary anæmia. But in these cases the amount of free hæmoglobin is so small, or it undergoes such changes, perhaps into bilirubin or other substances, that it neither appreciably colors the blood-serum nor escapes from the organism through the kidneys, giving rise to hæmoglobinuria. These mild degrees do not concern us here, and it is proposed to consider under this head only those cases in which the existence of hæmoglobinuria reveals the cythæmolysis.

There is one great class of cases in which the blood-destruction is wrought within the blood-vessels themselves—in which the hæmoglobinuria is clearly of systemic origin and a purely secondary manifestation. This class includes those cases which are traceable to the absorption into the blood of such chemical substances as sulphuric, muriatic, carbolic, and pyrogallic acids, chlorate of potassium, naphthol, nitro-benzol, arseniuretted hydrogen, and the like. The symptom also occurs in rare cases of the acute infectious diseases, as diphtheria, scarlet fever, and typhoid fever. It has been noted in connection with severe burns of the skin and sunstroke. Transfusion of the blood of another species of animal produces it. It is said to have been seen in the course of diseases characterized by hæmorrhage—scurvy and purpura for instance—though hæmaturia is here the rule. Finally, it is a prominent symptom in that peculiar and rapidly fatal infectious process in newborn children, marked furthermore by cyanosis and icterus, to which Winckel's name has been attached, though W. S. Bigelow[1] published in 1875 a full and accurate account of an outbreak which occurred in the Boston Lying-in Hospital during that year, thus antedating Winckel[2] four years.

In all of these conditions the treatment of the hæmoglobinæmia is that of the special cause which provokes it in each particular case, as far as this is possible.

But there remains a class of cases of great interest to which the name "paroxysmal hæmoglobinuria" has been given. The general opinion is that in these the hæmoglobinuria is a manifestation of hæmoglobinæmia, certainly in a great majority of cases, though Hayem[3] and Robin[4] maintain that the cythæmolysis is not systemic in these cases, but occurs only in the kidneys. If this view is correct, or in so far as it is correct, the consideration of the paroxysmal form

[1] *Boston Medical and Surgical Journal*, xcii. p. 277.
[2] *Deutsche med. Wochens.*, 1879.
[3] *La Semaine méd.*, 1889, Feb. 24. [4] Ibid., May 19, 1889.

comes under the head of diseases of the kidney rather than of the blood. It seems probable that both sides are right, some cases being systemic, some renal.

The chronic infectious diseases, syphilis and malaria, seem to underlie a certain proportion of the paroxysmal cases, and evidence as to the existence of these affections should always be sought for as a guide to treatment. But in many cases no definite constitutional taint can be made out, the two chief antecedents being exposure to cold and *walking* exercise. Striking cases are reported in which all other forms of exercise were perfectly well tolerated; but walking, not otherwise shown to be excessive, was followed by hæmoglobinuria, with or without pain in the back. It would seem that there must be some relationship between hæmoglobinuria and Raynaud's disease. Raynaud himself does not speak of having seen the association, but others have, and in a number of cases altogether too large to be attributable to coincidence alone. And yet there are striking points of difference; for instance, hæmoglobinuria is comparatively rare in females, while women seem much more liable to Raynaud's disease.

The treatment of paroxysmal hæmoglobinuria falls naturally into two divisions—that of the attacks and that of the prevention of their recurrence. Fortunately, the malady is very rarely fatal. During an attack warmth is the prime essential, and if there is marked general disturbance with fever, the patient is not unwilling to seek it in bed with hot bottles. If pain in the back is prominent, a poultice, to which mustard may be added with advantage, dry cups, or even an anodyne, are indicated. The late Dr. Druitt of London found hyoscyamus efficacious against this symptom in his own case. Even in cases without notable constitutional disturbance it is wise to insist on bed as soon as an attack appears or threatens.

The prevention of recurrences is to be attempted by great care in avoiding exposure to cold, especially during the early hours of the day, when experience shows that the attacks are most liable to come on. A hot drink should be taken before rising, and frequent meals should be taken in order to guard against exhaustion from lack of food. These precautions are the more necessary if arduous or unaccustomed work is to be undertaken during the day. It may be necessary to remain in the house throughout or during much of the winter, if refuge cannot be taken in a warm climate. Dr. Druitt found much benefit from wintering in Madras. The clothing should be chosen with special reference to warding off chill. Barlow and Ralfe endeavor to accustom their hæmoglobinuric patients to water gradually lowered in temperature, apparently without very gratifying results. It seems to be safer to abstain from alcoholic drinks and articles containing oxalic acid, and to be cautious in the use of asparagus, tea, coffee, and spices.

In short, a sufferer should give intelligent study to his own case, that he may ascertain and avoid as far as he can those exciting causes which operate on him. He may then hold his disease largely in abeyance if he cannot master it entirely. Quinine in large doses seems to be the best single drug, and should be tried faithfully even in cases without malarial history or exposure. If it fails, arsenic or Warburg's tincture may be used. Pampoukis and Chomatianos[1] of Athens cite a number of cases in which hæmoglobinuria was caused by quinine, especially the sulphate, in doses of eight grains or upward. Other salts of quinine and derivatives of cinchona-bark also produced the symptom of pain in the back in these cases, though larger doses were required. But cinchonine in doses of 30 grains, and quinquinia in large doses, proved innocent. These observers make a sharp distinction between these cases and those of malarial hæmoglobinuria, in which the symptom yields to quinine, and recommend the use of cinchonine or antipyrine in their treatment. Any evidence of syphilis calls loudly for specific treatment. If there is any resultant anæmia, iron should certainly be given. Astringents do not hold out much hope of usefulness, the essence of the trouble lying in destructive action on the red blood-corpuscles by some cause still unknown to us, but promoted more by exposure to cold than by any other one thing.

Addison's Disease.

If the diagnosis is correct, the most that can be expected from treatment is possibly palliation and the prolongation of an unenviable existance as comfortably as possible. This means rest, alimentation, fresh air, and a purely symptomatic medication. The liability to suddenly fatal syncope is to be borne in mind, and alcoholic stimulants are to be given freely during the attacks of great weakness which are not uncommon.

Hæmophilia.

The well-known hereditary character of this highly interesting constitutional affection suggests at once abstention from marriage by those subject to it, particularly by females, who are notoriously less likely to manifest the vice, though they are far more likely to transmit it to their descendants, than are males. Celibacy is probably not attainable by legislative enactment, and we must rely on voluntary action initiated and supported by medical authority. "At Tenna in the Grisons," we find in Fagge's *Practice*, "there were until lately two families, not known to be related to one another, in which the disease had been known to exist for a century. In 1855, the females of those families determined to renounce marriage, and in 1879 Immermann was able to state, on the authority of Dr. Hörsli of Tusis, that there was no

[1] *Progrès médicale*, July 7, 1889.

longer a well-marked example of hæmophilia in the village." So much for prophylaxis in the broad sense.

Jenner thinks that hæmophilia involves a tendency to plethora of the smaller vessels, and therefore recommends a light diet with but little red meat, and gentle purgation at stated intervals of a week or so. Legg thinks that after taking iron bleeding is less likely to occur, and to be less profuse if it does set in. A warm, dry climate is said to be of service. Those who are known to be "bleeders" should so govern their lives and select their occupation as to involve the least possible risk of blows and injuries. No surgical operation should be undertaken on them, not even the extraction of a tooth, unless it is absolutely indispensable; and then every conceivable precaution against hæmorrhage is to be taken until the healing process is quite complete, inasmuch as the recent thin cicatrix may reopen. Subcutaneous and deep extravasations, whether the result of injury or spontaneous, it is wise to let alone: sometimes they suppurate, but usually undergo absorption.

If bleeding has started, the usual measures for its arrest should be promptly instituted, carried out to the full, and continued longer than in ordinary persons. At the same time ergot, gallic acid, and the more astringent iron preparations are to be given internally in large doses, while mild purgation may be brought about if there is no intestinal blood-loss. The sulphate of sodium is specially recommended for the latter purpose. Hæmorrhage into joints is to be treated in the same way as if it occurred under other conditions; and it is to be borne in mind that synovitis may be closely simulated by articular extravasation, which is not necessarily preceded by trauma. The anæmia and debility following profuse bleeding are to be managed on general principles.

DISEASES OF THE LIVER, GALL-BLADDER, HEPATIC DUCTS, AND SPLEEN.

By J. H. MUSSER, M. D.

DISEASES OF THE LIVER.

THE liver is the largest glandular organ in the body, and is naturally supposed to play an important part in the phenomena of the living organism. Just what this part is, has been a subject of much speculation and experiment. Until recent years its one undoubted function was believed to be the secretion of bile. Later, we learned that within the liver starch was converted into sugar, and the function of glycogenesis was added. Undoubtedly, this organ is one for sanguinification, while certainly it is the seat of destruction of the red-blood corpuscles. In the liver we have long known that, as in muscle and other structures, a metabolism of albuminoid substance takes place, and urea and probably uric acid are formed. In fact, at one time it was thought that all urea and uric acid was created in the liver. Finally, a very important office has been given to the liver; that is, the function of destroying or creating a barrier to poisons that enter the portal circulation through the gastro-intestinal tract and vainly attempt to pass into the general circulation. The secretion of bile, the formation of glycogen, the formation of urea, the formation of white corpuscles, and the destruction and excretion of poisons absorbed from the intestines are, then, physiological offices of the liver.

On *a priori* grounds we can surmise such changes in the working of the liver as would cause a state of discomfort, local or general, which we would call disease, and because the functions are altered we would call it a functional disease. It is remarkable how little we know about the functional diseases of glands: consider, for instance, how little is known of the functional diseases of the salivary glands. And likewise with the liver, and particularly of its excretory function. Indeed, in the pathology of glands we are almost forced to conclude that which is always true, but not obvious, though conceivable—*i. e.* that only altered function and altered structure go hand in hand. Even after generations of wise talk we grope about. "Biliousness"

is often spoken of, "sluggish liver" or "torpidity of the liver" written about, "excess of bile" or "diminished secretion of bile" talked of. When we think of the functions of the intestinal tract, the part the bile plays in it, and how the bile is constantly reabsorbed by the portal vein and carried back to the liver, only to be discharged again in a never-ending round, we can readily appreciate how impossible it is to give a physiological classification of functional disorders of the excretory apparatus of the liver which would tally well with clinical facts.

From the works of Strümpell, Fagge, Pye-Smith, Charcot, and Jaccoud, representing the modern state of medicine in three countries, we can form an idea of the difficulties. Strümpell does not write a word of such disorders. Pye-Smith places all clinical phenomena probably due to functional disorder of the liver, including lithæmia, under bilious dyspepsia. Charcot follows the classification of Murchison, while Jaccoud in his work on *Internal Pathology* does not make reference to any functional disease.

The late Dr. Murchison wrote extensively on functional disorders of the liver, and concluded that other offices of the liver are of much higher importance than the secretion or excretion of bile, while disturbances of that function are of minimum importance, if recognizable at all.

Moreover, when it is remembered how intimately associated, physiologically, are the functions of the stomach, duodenum, pancreas, and liver, it can readily be seen how difficult it is to separate clinically functional disturbances of these organs, particularly as the symptoms are usually very similar.

It is worth while remarking that a "bilious attack," in the parlance of the past, is now considered to be due to an acute dyspepsia or acute gastric catarrh, and that "biliousness," characterized by furred tongue, bitter taste in the mouth, slow digestion, flatulency, and sluggish bowels with pasty stools, is due to chronic gastric catarrh, to both of which a slight congestion of the liver may be added. When the latter is present the conjunctivæ are muddy, the complexion is sallow, and the urine loaded with urates, while, in addition to the above symptoms, pain in the right hypochondrium or right shoulder corroborates the idea of hepatic derangement. Disorders of the other functions have expression in pronounced derangements which are written over the whole body, as in diabetes and lithiasis or rheumatism and gout.

Of disturbance of the function of the liver last mentioned, but little can be said. Is it possible that in certain types of individuals this function may be in abeyance, and thus so-called "biliousness" arise? Are the persons who are susceptible to certain foods made so because this function is not active? Many individuals cannot drink milk or eat eggs or take certain fish. Perhaps some such poison as a peptone

which should have been destroyed enters the circulation in the liver, and it may be that poisons for this reason act more violently at one time than at another.

Notwithstanding a warranted scepticism regarding functional disorder of the bile-secretion, the state just spoken of, "Biliousness," will be treated of in this paper. Disturbances of the other functions, glycogenesis and urea-formation, will be treated of in the proper sections on Diabetes and Lithæmia.

In common with glands in general, the liver is made up of its special cells and a vascular network woven together by connective tissue, and of channels or ducts to discharge the products of excretion. The large size of the glands increases in importance the size and function of the ducts, so that morbid changes in them are a frequent and serious element in the pathology of the organ. Morbid processes, therefore, may be limited to the cells, to the vessels, to the connective tissue, or to the tubes themselves. Structural alterations of the gland do not differ from like alterations in other organs, and hence, singly or combined, morbid processes of degeneration, of congestion, and of inflammation may occur. By accident of situation the liver is covered with peritoneum. This is not, strictly speaking, a part of the organ, and hence diseases of the membrane are properly included among peritoneal affections.

The hepatic cells may be the seat of cloudy swelling or parenchymatous degeneration or fatty degeneration, the connective tissue the seat of inflammation, and the vessels the seat of congestion and amyloid degeneration. The processes in the respective parts may be either acute or chronic. In addition, the vessels may be the seat of embolic or thrombotic processes, simple or infectious, followed by the train of morbid changes wont to arise under such circumstances; hence abscesses and infarctions occur. Intimately connected as all are, morbid processes in either one of the structural components soon invade or deleteriously involve the other. Sharp lines of demarcation of processes cannot be drawn, and congestions, degenerations, and inflammations exist together frequently. Moreover, the organ is a nucleus for parasitic diseases, chief of which is the echinococcus which leads to the formation of hydatid cysts.

The channels of excretion, as before intimated, are so large that morbid processes arise in them independently of the secretory substance proper. Made up of epithelial structure and of connective tissue, nourished by a generous blood-supply, degenerations, congestions, and inflammations would naturally be expected, and indeed do arise. Moreover, the epithelial structure of the tubules, subjected frequently to irritation, invites the development of inflammation characteristic of mucous surfaces, and of new formations, as cancer, just as the lym-

phatics and blood-vessels gape wide for stray cells from distant morbid areas of sarcomatous change. In a gross sense, when compared to the delicate processes first mentioned, such further change may arise as would lead to narrowing or complete closure of the channels, for the outflow of the bile is obstructed in its course, causing many ulterior results. The free outflow of bile may be interfered with, and it then becomes more concentrated, and finally gall-stones are formed.

From the foregoing summary we can readily appreciate the morbid states of the liver that require the attention of the therapeutist. In this essay the management of the following diseases, in the order indicated, will be discussed:

FUNCTIONAL DISORDERS.
"*Biliousness.*"

ORGANIC DISEASES.

OF THE CELLS.
The Degenerations.
Fatty.

OF THE VESSELS.
The Congestions.
Active.
Passive, including { nutmeg liver and / red atrophy.
Emboli and thrombi, as in (1) multiple abscess;
(2) thrombosis of portal vein, with occlusion or inflammation.
Amyloid disease.

OF THE CONNECTIVE TISSUE.
The Inflammations.
Acute diffused hepatitis
(acute yellow atrophy).
Acute localized hepatitis (abscess), { Tropical, / Traumatic.
Chronic hepatitis.
(Cirrhosis, { Alcoholic, / Hypertrophic, / Secondary.
Leukæmia.
Syphilitic hepatitis.)
Tuberculosis.

HYDATID CYST OF THE LIVER.

DISEASES OF THE BILIARY DUCTS.

Inflammations.

Acute catarrhal inflammation.

Acute purulent inflammation.

Chronic catarrhal inflammation.

Adhesive inflammation of the duct.

Occlusion of the ducts.

Carcinoma.

Gall-stones and their consequences.

DISEASES OF THE GALL-BLADDER.

Inflammations.

Acute.

Chronic, with enlargement.

It is not idle for the therapeutist to contemplate the functional derangements or organic processes that are possible in this or any other organ; for, on the one hand, he at once learns how limited are the resources derived from the Pharmacopœia for the cure of liver diseases, while upon the other he knows, from such knowledge, how the application of such remedial powers as removal of the cause of a given disease and attention to hygiene, including regulation of diet, habits, exercise, bathing, clothing, physical and mental labor, are powerful and essential factors for good, while the effects of climatic and balneological therapeutics are readily appreciated. This is particularly true with liver diseases, for in these the causes are very frequently preventable or controllable. Furthermore, hepatic disease, once developed, is often controlled by properly regulating the work of the economy and its varied organs to suit the changed structures. The changed liver must fit into a new environment, or rather an environment within the body must be created for the diseased organ. Harmony of function must be established throughout the system.

This can be done by regulating the physiological action of the liver. We must not be satisfied with securing such small gain, however. The entire organism must be treated—treated, not by drugs, but by means more powerful and more permanent. The plane of health must be raised by measures spoken of in the preceding paragraph. As a step in the right direction the various functions of the hepatic gland must be stimulated or repressed by proper diet. Usually repression or restriction of functional acts is necessary; the organ must be relieved of work. Hence certain classes of foods that are transformed or broken up in the liver, or that are acted upon by the bile, are to be excluded. The vascularity of the organ and the movements of the fluid contents of the tubes must be properly regulated. The use of proper food, exercise, clothing, and bathing attains this end. A high degree of general

health must be secured; and the methods previously indicated in Volume I. of this SYSTEM to attain this end require application in all forms of hepatic disease. They will be discussed, therefore, in a general manner before individual diseases are treated.

In the same general manner a few paragraphs will be devoted to the action of drugs in liver affections and the mode of administration of these remedies.

Symptoms common to many varieties of hepatic disease will be discussed, and the treatment of them as far as they do not appertain to special diseases will be detailed. Thus jaundice is common to many diseases. It is a symptom with symptoms. Space will be spared by devoting some remarks to it, as well as other symptoms, in a separate section. In like manner ascites and gastro-intestinal congestions will be treated.

Diet in Liver Diseases.—Much can be accomplished by carefully regulating the diet in both functional and organic diseases of the liver. In the first place, the amount of such foods as are utilized by the liver in the performance of its functions must be controlled, and for this reason sugars, starches, and fats are prohibited or curtailed in amount. Second, the use of preparations of food which are not stimulating must be enjoined. Richly-prepared foods—curries, pastries, soups highly seasoned—spices, and stimulating dishes generally must be excluded. Foods prepared in fatty substances are not admissible, and likewise all dishes made with sugar must be excluded. Usually, a certain amount of starchy food may be allowed if it is properly prepared; thus pastries and bread freshly made are not to be used; but, unless a very rigid diet is necessary, bread stale or toasted may be allowed in smaller quantities than usual. Saccharine articles of diet must be particularly excluded, not only because the liver is relieved of work, but especially because of fermentation due to intestinal dyspepsia, which almost certainly accompanies hepatic disorders.

In the later stages of organic hepatic disease and in advanced congestion red meat should not be allowed, but white meats and game are admissible. Fish and oysters can always be used, except salmon, eel, and other fish of an oily nature. Eggs and milk, and preparations of each, are proper if they agree with the patient, but some persons, on account of idiosyncrasy, find it difficult to take them. Often under these circumstances milk, which otherwise causes so-called "biliousness," may be used if it is sterilized or if it has previously been peptonized. It also may be more suitable to a patient if administered hot—not boiled, but scalded, and with a little salt added. Alkalies added to the milk render it less disagreeable at times. Lime-water, or bicarbonate of sodium, or a carbonated alkaline water, such as Vichy, removes the unpleasant taste that many patients complain of and renders the milk

more readily assimilated. In place of milk, whey or buttermilk may be used; the slight acidity of the latter is very agreeable to some patients, and both appear to be of advantage if a diuretic effect is required. Nourishment may be sustained by koumyss and other artificially prepared forms of milk. To bridge over a critical period malted milk may be employed, or condensed milk will stand in good service. The latter may be flavored with weak infusions of tea or cocoa to make it more palatable.

While sugars and starches are to be excluded in hepatic disorders, and beans, potatoes, peas, and other legumes forbidden, for a time at least; fresh vegetables generally may be used. Lettuce, if not dressed in oil, celery, spinach, tomato, squash, pumpkin, oyster-plant, and the like, are vegetables from which a number of palatable and serviceable dishes may be made.

In the selection of food the dictum of the late Professor Flint must be observed. The appetite and common sense are to be consulted. It is never to be forgotten that most serious results may ensue from continuing a strictly exclusive diet too long. The effect of a rigid diet on the stomach and the general system must be noted carefully. In every case a return to a general diet is necessary. Some of the most severe cases of functional gastric disorder arise from a too restricted dietary.

Ale, porter, and beer should not be used. All sweet wines must be interdicted. Acid wines alone are advisable if a stimulant is actually required, and some of the more acid clarets or the Rhine wines may be used. Champagne, madeira, port, and sherry must be prohibited. Coffee should almost always be forbidden; it may be used sparingly, provided the state of the gastric functions do not contraindicate it. Preparations of cocoa, if free from the oily substance that so usually accompanies them, may be given.

While a selection of proper diet is necessary, it is also well to insist upon proper methods of eating. Food should not be taken when the body is fatigued. If at the usual time for a meal the patient feels exhausted, fifteen minutes' or a half hour's rest in the recumbent posture should be insisted upon before partaking of food. At the time of resting a plate of light soup may be given. The acts of mastication should be performed properly, and this must be particularly insisted upon if some starchy food is allowed. If the patient cannot masticate properly on account of bad teeth, these should be attended to at once. Food should be eaten slowly and mixed with only a moderate amount of fluids. In certain forms of liver disease, to be spoken of later, fluids must be excluded almost entirely. It is often necessary to administer the food frequently, and indeed in congestion of the liver and extensive organic disease it is much better to give food four or five times, rather than three times, a day.

Exercise.—An out-door life and exercise within reasonable limits are of the greatest importance in the management of liver disease. Such exercise as will contribute to the general health is advised, as well as exercise which stimulates the abdominal circulation. It is particularly necessary to those who are leading a sedentary life or occupation. The exercise should not be violent, and it should develop the muscles of respiration as well as the abdominal muscles. This is quite necessary, for when the respiratory acts are complete circulation is more active in the liver. Of forms of exercise for increasing the abdominal circulation horseback riding and rowing are the best. Walking is not so good. Half an hour of either of the former is of more service than two hours of the latter. If exercise cannot be secured in the open air, gymnastics may be resorted to, and special training of the muscles just indicated is necessary. Massage must be prescribed for those who are unable to go about or take exercise as they should. The object of massage is more particularly to develop the muscles, to increase the functions of the skin, and, in certain forms of disease, notably functional disorders with constipation, the congestions of sedentary life, and the fat liver of the obese, to stimulate the circulation in the abdomen.

Climate.—The climate selected for invalids suffering from liver disease should be stimulating and tonic in character. The mountains of Switzerland are usually selected by the physicians of Carlsbad and other springs in Germany for patients to resort to in order to complete a cure. Residence by the sea is of benefit to many.

In the United States country life generally answers, and Northern New England and Northern New York furnish an abundance of places where the summers can be spent profitably. The robust who suffer from functional liver disorder do well camping out. A summer on the Plains, in the woods of the Adirondacks, or in Northern Canada changes almost entirely the physical condition and mental state of a man who by sedentary life and prolonged application has become a physical wreck. The winter months could be profitably spent in the southern and south-western parts of the United States. It is essential to remember that an out-door life with exercise is necessary for success in the treatment of properly selected cases of liver disease.

Of course diseases of the liver which arise on account of climatic influences require change to other countries. The Englishman in India must return home, and patients in insalubrious climates must promptly leave if hepatic disease arise. Non-malarious districts must be selected by persons in whom liver disease has originated on account of malaria.

Clothing.—The clothing should always be warm and its weight graduated to the temperature; woollens should be used and the extremi-

ties be well protected. Every one who by occupation or residence is liable to congestion of the liver should have the hepatic region and abdomen protected by wearing a heavy flannel bandage. Heavy boots should always be worn. The habit of wearing slippers should be corrected.

Bathing.—General baths, cold sponge-baths, or douches should be insisted upon in order to keep up the action of the skin, as well as for their tonic effect. The cold shower-bath, followed by a brisk rubbing, or a plunge in a tub of cold water, with rubbing afterward, providing reaction always takes place, will ensure healthy action of the skin and give general tone to the patient. Such baths are particularly necessary in patients of sedentary occupation, who lack opportunities for acquiring tone and keeping up that state of the system which attends high health. Sea-bathing with the usual precautions will be of great value to broken-down subjects.

Medicated baths are used for chronic diseases of the liver. The acid bath is the one most frequently employed. Eight ounces of nitro-hydrochloric acid are mixed with each gallon of water at 98° F. The same solution may be applied as a compress. A flannel roller about a foot wide and long enough to go twice around the body is saturated in the acidulated water, wrung out thoroughly, and wrapped around the region of the liver. It should be covered with a piece of oiled silk slightly broader than the flannel, and may be worn several days or until decided irritation of the skin is produced. It should be changed every night. If an acid bath is given, the vessel must be of wood, earthenware, or porcelain.

Hot baths are prescribed at many of the springs where the waters are taken for liver disease. At home the general hot bath relieves the pain of hepatic colic and aids the passage of the gall-stone. In congestion of the liver the hot bath, with good rubbing afterward, is of great service. The enlarged, congested liver after catarrhal jaundice is reduced by baths. The sitz-bath is of value for the relief of abdominal plethora. At Carlsbad peat- or mud-baths are used for the same purpose. After each hot bath the patient should rest for two hours. The bath should not be taken until one and a half hours after a full meal, and not after violent exercise or great mental excitement: the morning hours are the best. The bath may be taken on retiring, although additional rest is not secured. The water should usually be at a temperature of 90° to 95° F., but it may be raised to 100°.

Hot baths are weakening, and should be taken only two or three times a week. If congestion of the brain, as evidenced by giddiness, noise in the ears, or pain in the head, occurs, the patient should not take them.

The baths may be medicated, although the value of the medication

is doubtful. Carlsbad Sprudel salt added to the water may be of service, or bicarbonate of sodium may be used. For stimulating purposes common or rock salt may be added to the water.

Vapor-baths and douches are often very useful. Douches or "needle"-baths, or alternating hot and cold douches played on the liver, are local stimulants of value. The Turkish bath may be used by the robust. In jaundice it aids in removing the discoloration of the skin.

Residence.—Persons in whom there is a tendency to, or who are the victims of, diseases of the liver should reside in a neighborhood that is dry. The house, of course, should be supplied with all sanitary comforts, and hence the drainage should be of the best. For patients with chronic liver disease a house that is exposed to the sun during the most of the day and sheltered from high winds is of course the best, and to the house a conservatory or sun-parlor in which the patient can take exercise ought to be attached.

Occupation.—Of course a sedentary occupation for those who are liable to attacks of biliousness, so called, or who have other manifestations of disordered hepatic functions, should not be permitted. If possible, an out-door occupation which admits of change of posture during business should be selected. Often one which involves horseback riding or methods of locomotion which compel exercise of most of the muscles of the body should be advised. The bicycle has been of service in restoring to health many cases of congestion of the liver or of fatty liver due to over-eating and sedentary occupation.

Occupations which compel the patient to be constantly nibbling at rich foods and condiments, or sipping at alcoholic drinks, are to be condemned. Some individuals who are exposed to sudden and marked changes of temperature or to repeated wetting of the skin are thereby rendered more liable to hepatic disorders. Laborers in rolling-mills, furnaces, or in damp, wet places belong to this class.

The foregoing are simply hints at occupations that are disadvantageous. Often in individual cases, if sought for, the causal relation of occupation to disease may be disclosed.

Habits.—Luxurious habits must be dispensed with. In the prevention and treatment of hepatic disease the establishment of regular, systematic habits of life is of the greatest importance. Proper and fixed hours for retiring and rising, for meals, for work, for rest, for bathing and exercise, must be secured. If coupled with proper food, nothing is more certain to produce good results in medicine than a régime of this character.

Action of Drugs on the Liver, and the Method of their Administration.

Drugs which act on the liver and increase the flow of bile are known as hepatic stimulants; if they diminish the flow of bile, they are known as hepatic depressants. Although the secretion of the bile is increased by hepatic stimulants, it is not carried out of the system. Drugs which act upon the intestine, and in that manner remove bile from the body, are known as cholagogues. Therefore, in order to carry off bile from the body very thoroughly, it is necessary to combine an hepatic stimulant with a cholagogue. Any active purgative is an hepatic depressant. It carries away bile that would be re-excreted and food that would help to make bile.

Hepatic Stimulants.—Food is an hepatic stimulant. After a meal the flow of bile is rapidly increased. Some classes of food appear to cause this increase more freely than others. The succulent vegetables, as spinach, tomatoes, the cresses, and the like, are thought to have such an effect, and should be included, unless otherwise objectionable, in any regimen which attempts to increase biliary secretion.

Water is also an hepatic stimulant. Its virtue is increased if taken hot, and also if taken when the stomach is empty. The hot water is quickly absorbed. It enters the portal circulation and is carried directly to the liver. The pressure in the blood-vessels is increased by rapid absorption of the water, and the pressure on the bile-ducts is also increased; hence bile which is present is carried out of the ducts more rapidly, and practically the liver is washed out. If to the hot water some saline is added which by experiment we know increases the flow of bile, the effects of the water are much increased. The salts of Carlsbad (which contain a large amount of phosphate of sodium), the phosphate of sodium alone, or any of the alkalies included in the list of drugs when administered for the purpose of relieving congestion, and overcoming stagnation of bile or cholelithiasis, act very well. It is by virtue of this effect that springs the waters of which are alkaline and charged with carbonic acid are in vogue in cases of liver disease. No one can doubt the effect of taking the waters at one of the popular springs, but this effect is much increased by the strict regimen that the patient follows while pursuing the treatment. The springs which are best suited for cases of liver disease are those of Carlsbad, Marienbad, Kissingen in Germany, and Vichy and Contrexeville in France, and in this country Saratoga and Bedford.

Just here it may be worth while to speak of the class of diseases benefited at these resorts, and give some indication which will be of

value to the clinician who wishes to send patients to them. The cases that are most benefited by springs, such as those of Carlsbad, are those suffering from chronic congestion of the liver, fatty liver, the first stage of cirrhosis of the liver, and cholelithiasis or gall-stones. Amyloid disease of the liver, if associated with much congestion of the abdominal viscera, may be improved by the use of such waters. The use of the waters of these springs is contraindicated in any of these diseases just mentioned if they are accompanied by high fever. If there is also the simultaneous occurrence of organic disease of the brain or spinal cord, tuberculosis, valvular disease of the heart, or Bright's disease of the kidney, the waters should not be taken. Cancer of the liver and malignant tumors generally should not be treated in this manner.

It must be remembered that patients who go to springs for relief must not expect to leave the "cure" and at once return to their avocations in good health. This is particularly true when the waters of hot springs, which appear to be the best, are taken. The action of these waters is rather weakening. It is by depletion that the patient is relieved. It is necessary, therefore, to complete a cure by residence at other springs which are more tonic or by rest and quiet in the mountains. Patients at Carlsbad usually go to Switzerland, or they carry out a subsequent course of treatment in a milder degree at springs which do not act so vigorously. In this country if a patient has been benefited by the waters of Saratoga or Bedford or the Hot Springs of Arkansas, it is well that he should go to the seashore for rest.

It has been stated that the good effects of the waters are increased by the strictly hygienic life which the patients lead at certain springs. It is unfortunate that in this country the springs which are of value for the relief of liver diseases as well as other complaints are used so much by the votaries of fashion. The many distractions that exist at these places, and the constant catering of the citizens and hotel proprietors to fashionable people, render it very difficult for an invalid to carry out a systematic plan of treatment. It is to be hoped that in the future the creation of a proper sentiment will aid in changing these resorts into their proper channels. This is more possible each year, for with the increase of wealth in the country more patients will resort to the springs who can make it an object for the owners to cater to them and their needs. The broadening of therapeutic methods by the physicians of the day will also render such plans of treatment more popular.

Both experimental evidence and clinical experience show that the bile-secretion is increased when milk, hot water, or other fluid is taken slowly. Brunton and others have shown that the act of sipping is a

stimulus to those centres which control arterial pressure and the heart itself. Beyond doubt, sipping water with exercise, as carried out at Carlsbad, increases the secretion of bile. It increases the blood-pressure within the liver, and hence the bile-pressure. Exercise always helps the action of medicines upon the liver. Both the above adjuncts are particularly useful in connection with a carefully-planned regimen, as conducted at most springs.

It has been thought by some observers that medicaments for the liver had better be taken in large quantities of water, fasting, in order that the liver may be promptly acted upon. In this manner Guitéras and Bruen used iodide of potassium in chronic catarrhal jaundice in small doses in a glass of hot water before breakfast. Other drugs may be employed in a similar manner.

In the main, our empirical knowledge, derived from clinical experience, as to the drugs which stimulate the liver is correct, as recent experiments by Rutherford and Vignal, and by Röhrig, have corroborated this knowledge. In one or two instances the clinician was notably wrong. It was formerly thought that the mild chloride of mercury was an hepatic stimulant of the first rank. Its administration had always been followed by the discharge of so-called bile and by relief from the bilious symptoms. It was proven by the above-named experimenters that such is not the case, and that the supposed action of calomel on the liver is due to the transformation of the drug into the bichloride of mercury, the effect produced being due to the action of the latter and the purgative effect of the former. In this way calomel is an hepatic stimulant and cholagogue, and without doubt is more efficient in small and frequently repeated doses. In certain states to which the term "biliousness" is applied it is the best drug we have. It is also an intestinal antiseptic.

The following classification is that of Rutherford, and by it the practitioner can at a glance see the armamentarium with which he can attack hepatic disorders:

Powerful hepatic stimulants:

Podophyllin,
Aloes in large doses,
Colchicum in very large doses,
Euonymin,
Iridin,
Sanguinarin,
Ipecacuanha,
Colocynth in large doses,
Dilute nitro-hydrochloric acid,
Sodium phosphate,
Potassium sulphate,
Phytolaccin,
Sodium benzoate,
Ammonium benzoate (less than the latter),
Sodium salicylate,
Ammonium phosphate,
Mercuric chloride.

Moderately powerful stimulants:

Leptandra,
Jalap,
Sodium sulphate,
Baptisin,
Hydrastin,
Juglandin,
Benzoic acid.

Drugs that have feeble or no effect:

Croton oil,
Rhubarb (certain, but feeble),
Magnesium sulphate,
Castor oil,
Gamboge,
Ammonium chloride,
Scammony,
Taraxacum,
Rochelle salt,
Sodium bicarbonate,
Potassium iodide,
Calabar bean (autogenized by atropine, not powerfully),
Menispermin,
Tannic acid,
Acetate of lead (lessens the secretion of bile),
Jaborandi,
Sulphate of manganese,
Morphine,
Hyoscyamus,
Diluted alcohol,
Calomel.

If it is desirable to carry bile out of the system as well as increase the secretion, drugs which have both effects in a moderate degree may be combined. It is always important not to secure a severe purgative effect, such as that induced by magnesium salts or castor oil. If great purgation takes place, the secretion of bile is diminished. Hence, clinically, aloes is not a good hepatic stimulant; theoretically, it is one of the best.

If it be remembered that certain drugs are not well borne by persons of a so-called bilious temperament, the therapeutist will often save much trouble, and even gain a reputation in a laudable way. The drugs which cause constipation by arresting secretion are most harmful. Preparations of iron are usually not well assimilated and create disturbances. Opium and its alkaloids also cause disagreeable symptoms, and cannot be taken even in small amounts by some.

Symptoms of Hepatic Disease.

The treatment of symptoms common to many disorders of the liver will now be discussed. The first symptom mentioned, ascites, occurs in all forms of chronic hepatitis, in cancer of the liver, and in inflammation and thrombosis of the portal vein.

Ascites.—The measures employed to remove the collection of fluid in the peritoneal cavity are of a depletory nature. Diaphoretics, diuretics, and cathartics are used in turn singly or combined. Surgical means

must be resorted to at times, and indeed it is a grave question whether it should not be resorted to much earlier than is customary, particularly in cases of cirrhosis.

Moderate diaphoresis at least should always be secured by suitable clothing, frictions, and the maintenance of a proper temperature of the room. It is scarcely advisable, unless there is general anasarca with associated renal disease, to use diaphoretics that produce profuse flow of perspiration—such as the hot wet pack, Simpson bath, and jaborandi and its alkaloid. Active diaphoresis by this means may be used at rare times.

Diuretics are of more service, and diuretics which act by means of their tonic effects upon the general circulation are of the greatest benefit. Stimulating diuretics, so called, are also of value. To the former class belong drugs like digitalis, caffeine, cocaine, and strophanthus. When the heart is weak or dilated, some one of these drugs is indicated without doubt, but they may be likewise used when the physical signs of cardiac dilatation are not present. The best of these is digitalis, of which the tincture or infusion may be used: large doses should be given, and hence 10 or 15 drops of the former and 1 or 2 table-spoonfuls of the latter every three hours are needed. Tincture of strophanthus is often of great value, but its effect is soon lost unless the dose is frequently increased. If 5 drops are administered at first, the dose should be increased every three or four days to 10, 15, or 20 drops. Caffeine is also a good diuretic, and acts well in cases of ascites. It has the disadvantage of causing wakefulness, which is very persistent in some individuals. From 2 to 5 grains of the drug given every three or four hours promote abundant secretion. Hydrochlorate of cocaine increases the action of the kidneys when the effects of other drugs appear to be lost. One-fourth of a grain administered every three hours is sufficient to cause an increase in the flow of urine. It may be given with other diuretics, as will be indicated in another paragraph.

The diuretics which belong to the stimulating class stand next in order, the best of them being copaiba. This drug should be administered in capsules in doses of 5 to 10 minims three or four times daily. It almost always produces an increase in the flow of urine. Scoparius is used a great deal, and is often of much value. The infusion, taken *ad libitum*, is a domestic remedy to increase the action of the kidneys. An alkaline diuretic is often combined with it, and a wine-glassful of an infusion, freshly made each day, may be given every three hours with 10 to 20 grains of acetate of potassium or bicarbonate of potassium. Cream of tartar, administered in the form of cream-of-tartar lemonade, or the "imperial drink," is another diuretic which may be substituted for an infusion of scoparius when the latter becomes nau-

seous. It frequently does good service. The oil of juniper or the compound spirit will often avail. The tincture of apocynum cannabinum was advised by older writers, and the writer has seen several instances of good effects of this drug. It acts chiefly as a diuretic, but often at the same time causes purgation—an effect generally desirable. From 10 to 20 drops of the tincture every two or three hours, well diluted, are used.

One of the best diuretics is calomel. It certainly increases the flow of urine very much, and in the course of treatment of ascites may be alternated with other diuretics. The usual mode of administration is to give it in $\frac{1}{2}$-grain doses every three hours. The writer has seen a patient not only very ascitic, but water-logged, relieved by the administration of this drug. It has the advantage that it can be given when the stomach refuses to accept other drugs. Calomel may be combined with other diuretics. When the tongue is furred and nausea is present with constipation, calomel combined with caffeine acts very well: the influence of the calomel on the gastro-intestinal tract is secured, and a diuretic effect is obtained from both drugs. Under these circumstances caffeine will be retained by the stomach when other diuretics will be vomited.

A very valuable diuretic is secured in the combination of calomel, squill, and digitalis: a pill containing 1 grain of digitalis, $\frac{1}{2}$ grain of squill, and $\frac{1}{8}$ grain of calomel, administered three times a day, very promptly produces an increase in the flow of urine, and is one of the best diuretics that can be employed.

Purgatives are essential. Either salines or the vegetable cathartics which produce watery evacuations are to be selected. Saline cathartics alone may be sufficient: 6 to 10 ounces of the effervescing citrate of magnesium, repeated two or three times in the morning, will produce free, watery evacuations, attended with diminution of the ascites. Rochelle salt, administered in the morning, is likewise of service, as is the sulphate of magnesium. Hunyadi water, Friederichshall water, the German bitter water, and the purgative waters of Saratoga, Bedford, and other springs in this country, are also useful.

Compound jalap powder is a serviceable purgative. Copious stools are produced without causing exhaustion of the patient. A drachm may be administered daily, and repeated if necessary once or twice in the twenty-four hours. It may be used thus for a week unless exhaustion becomes marked. It does not usually cause pain. Elaterium is another purgative which is of service. Clutterbuck's elaterium, $\frac{1}{4}$ or $\frac{1}{2}$ grain, will usually produce free catharsis. It should not be administered, however, continuously, but reserved for emergencies.

In addition to the class of drugs just mentioned, tonics are called for. The full effect of a diuretic is kept up by the use of strychnine, increasing its dose in accordance with the susceptibility of the patient.

Faradization of the abdominal walls has been recommended by some clinicians for the relief of ascites. Cases have been reported in which, following the use of this method, the dropsy gradually disappeared; the cases, however, are too few to give us much confidence in this form of treatment.

It must not be forgotten that rest, combined with a milk diet and diuretics, is of the greatest importance. The milk-cure and grape-cure must be utilized.

Tapping the abdomen is a certain way to remove an accumulation of fluid in the peritoneal cavity. The question does not arise in the mind of the therapeutist whether it is a measure which will succeed, but rather whether this operation should be done early or postponed until serious symptoms develop on account of the large accumulation of fluid. The fluid within the cavity interferes with the circulation and nutrition of organs, prevents free movement of fluid in the lymph-spaces by pressure, certainly interferes with the action of the kidneys, and for these reasons should be removed early. So many failures attend the use of drugs that the writer feels sure, particularly as paracentesis is fraught with so little danger, that this method of removing the fluid should be resorted to early—before changes due to pressure become permanent. If done early, the fluid is not likely to reaccumulate, and even if it should there is no reason why frequent aspiration should not be done. There are a number of cases on record which have been tapped many times with no bad results. The dangers thought to attend the performance of this operation are peritonitis and septicæmia from primary infection or after non-closure of the punctured wound. In the writer's experience they have been of little moment, and in no case have any deleterious results followed tapping. Sometimes after tapping the puncture does not close, and it is thought that the drainage that results is weakening and indirectly causes the death of the patient. This has not been the case in the large number of patients the writer has treated. When the wound did not close the constant dripping of the fluid seemed beneficial to the patient. Such benefit is seen in cases in which Nature performs the operation. In two instances the writer has observed rupture to take place at the umbilicus, followed by gradual draining of the cavity, with most beneficial results. It does not appear to exhaust the patient to tap frequently, although some assert that such is the case, and argue against early tapping on this account. If, however, the physician does not believe in early tapping for the treatment

of ascites, there are certain indications for the performance of aspiration later. When the fluid accumulates to such an extent as to interfere seriously with respiration and the action of the heart, and, probably, causes attacks of palpitation or of smothering, then the operation must be performed.

Dislocation of the heart, increased frequency of action of that organ, with shallow and hurried breathing, are serious effects of ascites. Even before more marked threatening symptoms occur, in the writer's opinion the abdomen should be tapped whenever it has become so large as to compel the patient to assume an upright position in bed. If the operation is delayed, death frequently takes place suddenly on account of interference with the heart's action, especially after exertion, even if symptoms pointing to this interference have not been present previously.

Paracentesis Abdominis.—The instruments required are simple. An ordinary trocar and canula may be employed. Southey's trocars, or the trocar and canula which Dr. Douglass Powell devised, are used if it is thought better to drain gradually. In order to remove the fluid without soiling the patient and bedding, a flexible rubber tube may be attached to the trocar to conduct the fluid to a vessel near the bed. The abdomen should be cleaned with an antiseptic solution in accordance with the rules for the performance of any abdominal operation. The bladder should be emptied before the operation and the patient given a stimulant. The point selected for inserting the trocar should be in the median line, about midway between the umbilicus and symphysis pubis, or about four inches above the latter point. Before the operation the abdomen should be enveloped in a broad bandage, the ends of which have been equally divided into a number of tails, and this bandage held in place by an assistant at the back of the patient. In order to induce gentle, equable pressure over the abdomen and support the abdominal walls, traction on the different portions of the bandage should be made as the fluid flows out; first the tails in the upper portion should be drawn upon, and as the abdomen decreases in size the middle and lower tails should be tightened. When the operation is completed they may be tied at the back or side. In order to prevent pain, the skin at the point determined for puncture should be anæsthetized. This may be done with salt and ice, holding them in contact with the skin until it is frozen. Rhigoline spray or other methods of anæsthetizing the skin may be used. During the flow of the fluid the patient often becomes faint, and stimulants should be administered at this time. Sometimes the fluid becomes bloody as it flows out. This should not necessarily cause alarm. If the trocar comes in contact with the intestine, it may cause a little bleeding, or adhesions may also be the cause of the flow of blood. Very frequently it occurs

at the latter part of the operation, and comes from the wound in the abdominal wall.

Should all the fluid be removed? Probably with the first aspiration, especially if the accumulation had been very great, the entire amount should not be removed at once, but more thorough aspiration done the next day. If, however, no uncomfortable symptoms arise and the fluid is small in amount, it may all be withdrawn with safety. This can be quite well accomplished by the pressure of the bandage on the abdominal walls, aided by pressure of the hands of the assistant in the flanks, and, if necessary, tilting the external end of the trocar upward in order to reach the fluid in the lowest portions. The patient may safely lean forward in order to favor the gravity of the fluid toward the trocar. After removing the trocar, which should be done rapidly, the point of puncture should be covered with borated cotton or an antiseptic dressing held in place by adhesive strips. Some authors advise closing the wound by a stitch if leakage continues after operation, but, as stated above, the writer does not fear any bad results from this leakage, and would let it alone.

It is not to be forgotten that freezing the skin in old people or debilitated subjects may cause serious sloughing, hence in such cases it should be avoided or else great care exercised.

Jaundice.—The method of treatment selected for the relief of this symptom will depend entirely upon the cause. Jaundice that arises from catarrhal inflammation of the bile-ducts requires treatment directed to the relief of the associated catarrh. In jaundice from obstruction by gall-stones efforts should be made to remove the stones and cure the state which leads to their formation. If the obstruction is irremovable by medical means, surgical interference will be necessary. Jaundice due to obstruction from causes outside of the duct, as well as from malignant diseases or organic diseases of the duct, such as stricture, adhesive inflammation, etc., is treated as a symptom only, the cause being generally not removable. Jaundice which occurs independently of mechanical obstruction of the ducts is likewise treated on general principles. The cause, if possible, is removed, and the deleterious effects of the presence of bile in the blood and tissues is counteracted by remedial measures. In this section jaundice will be discussed as a symptom only, bearing in mind the general principle of the removal of the cause if possible.

The most serious effects of jaundice are upon the blood and the nerve-structures. Such methods should be used as will keep up the integrity of the blood as much as possible. This can only be done by the food and stimulants which ensure the highest degree of nutrition possible. The character of the food selected must be in accordance with the principles of the dietetic management of liver disease.

Tonics and stimulants also are required. In addition to proper feeding, attempts must be made to eliminate the bile as rapidly as possible, and therefore one of the first principles of the treatment of jaundice is to attend to the secretions. The bile is discharged from the blood chiefly by the kidneys, and the functions of these organs should be kept active. This must be accomplished, first, by hygienic regulations that will ensure their action and prevent congestion or inflammations; secondly, by the use of food and fluids which tend to increase the flow of urine. Large amounts of water are of use, and milk and diluents may be given freely. The mild diuretics are admissible. Alkaline waters that are diuretic and the alkaline chalybeate waters are preferable. Citrate of potassium, bicarbonate of potassium, cream of tartar well diluted, and infusion of scoparius are the diuretics to be selected. The action of the heart must be watched closely, and digitalis given as a diuretic, and also with the view of keeping up the strength of the heart. Any tendency to diminution in the flow of urine should be met by cupping over the kidneys, by rest, and by diversion of the blood to the skin, with diaphoretics and warm applications; or a hot bath may be used. The constant irritating effect of the bile is liable to excite nephritis, and this must be carefully guarded against if possible.

Jaundice is always attended by mental sluggishness, drowsiness, or even stupor, increasing to coma. Just as the effects on the blood are to be averted by the elimination of bile, so when symptoms of stupor develop the organs which discharge bile should be stimulated. Increased action of the skin and the kidneys must be secured. Stimulants must be used in the more severe cases, and preparations of ammonia administered freely. Apart from stimulants there are no drugs which will relieve the symptoms of cholæmia—symptoms which are always very grave.

Itching.—The sleep of the patient is so much disturbed, and the nervous system so perturbed by the itching that frequently ensues in all forms of jaundice, that some means must be used to control it. In former times it was thought that the itching was an indication of the obstructive form of jaundice, but undoubtedly it is seen in all varieties, and grave obstructive jaundice may occur without itching. Warm baths, sponging the body with hot water, and stimulating frictions may suffice. Solutions of bichloride of mercury, 1 : 10,000, are often beneficial. Hot alkaline waters, as bicarbonate of sodium, ½ ounce to the gallon, may be required; sponging with 10 to 20 drops of carbolic acid in a pint of water will also relieve the troublesome itching. Frequently remedies that induce a general action of the skin are of service. Hot drinks may allay the itching for a time, hot sage tea being used by a number of practical physicians with good results. Hot alkaline dia-

phoretics likewise will give some relief. Dr. Goodhart has recommended the use of pilocarpine and gives very strong testimony in its favor. The drug is administered hypodermically, and its administration is followed by relief after a few hours; $\frac{1}{12}$ grain is given in each dose. In the use of the bichloride of mercury care must be taken not to employ it too freely when the skin is broken by scratch-marks. Discoloration of the skin may be removed or its removal hastened by hot baths or hot alkaline baths, by the use of frictions, and by the application of stimulating liniments to the surface of the body.

The derangements of digestion that attend jaundice are to be relieved by a diet carefully selected and regularly administered. Articles that undergo fermentation are forbidden. When jaundice is present, there is usually deranged secretion of bile, and hence foods the digestion and assimilation of which depend upon this fluid in the intestinal canal must be excluded. It is sufficient to say that starches, fats, and sugars are to be left out of the dietary. Flatulency is usually a very marked symptom, on account of the fermentation due to the absence of bile. It may be relieved by drugs that prevent fermentation, such as carbolic acid, creasote, naphthol, salicylic acid, and salol. If these remedies do not give relief, absorbents may be necessary. Bismuth and charcoal are the best of this class. Drugs that aid intestinal digestion are of service. Pancreatin and preparations of a like nature relieve the symptoms. Formerly the deficiency of bile was supplied by the use of inspissated ox-gall, and it has been thought that by 5- or 10-grain doses every five hours the indications are fully met and the antifermentative and laxative effects of bile secured. The large amount of bile in the intestinal canal in health renders it quite doubtful that such small doses are of much service. The purgative effect of healthy bile in the intestine must be secured by the use of laxatives. The alkaline and purgative waters may be used, or the phosphate of sodium and drugs of a similar character may be given. Constipation must be relieved or it will become a very troublesome and distressing symptom, particularly if flatulency accompanies it.

In some forms of jaundice it is not advisable to use drugs which stimulate the secretion of bile very much. In fact, in all forms of jaundice from obstruction they should be excluded. If the purgatives suggested cannot be administered, the bowels should be opened by an enema or a glycerin suppository.

Hæmorrhages.—Hæmorrhages occurring in jaundice are an indication of the condition of the blood. They can be foreseen almost always if careful observations of the globular richness of the blood are made. They are most difficult to control, and are, in the first place, to be prevented, if possible, by healing up all abraded or

ulcerating surfaces that may be present, and by taking care not to cause any wounds. Surgical operations are not to be considered unless absolutely unavoidable. If they must be performed, they should be done before the richness of the blood is much reduced. Hæmorrhages may occur from the nose, the fauces, the stomach, and the bowels. They are to be treated by the local application of unirritating astringents, by cold, by rest in bed, injections of ice-water into the nostrils or fauces, or large enemata of ice-water into the rectum when they arise in this region. Ice may be swallowed for gastric hæmorrhage, and cold applied to the epigastrium. The internal administration of astringents, as gallic acid, astringent solutions of iron, or diluted aromatic sulphuric acid, is advisable. Rockbridge alum-water, taken internally, appeared to have had some effect in checking the hæmorrhages of intense jaundice in a case occurring in the practice of the writer. Artificial solutions of alum-water may be used for hæmorrhages that are external or in those occurring in the nose or rectum. Turpentine and hydrastis are useful, and preparations of ergot are advised. The latter drugs are usually most nauseous to patients, especially those with liver disease.

Vomiting.—Vomiting is liable to occur in many forms of liver disease. It arises usually from congestion or from fulness of the portal circulation due to obstruction of the circulation of the liver. It occurs reflexly when gall-stones are moving or attempting to move in the bile-ducts or gall-bladder. In order to relieve the symptom the patient must be properly fed with liquids. They should be frequently administered in small quantities. Lime-water should be added to milk in proper proportions, or carbonated waters may take its place. Carbonated waters, as the plain soda-water of the shops, may also be used with much advantage. Champagne will often be of service. Kommyss, whey, and buttermilk often answer if given in small quantities frequently. External applications may be used, such as mustard or any similar counter-irritant. When the vomiting is protracted a fly blister should be applied to the epigastrium. After vesication is produced the raw surface may be dusted with morphine. The choice of internal remedies depends upon the cause. If the vomiting is associated with portal congestion, it must be relieved by enemata, particularly if purgatives are not retained by the stomach. The mercurials, and especially calomel, in small doses will produce catharsis, and in that way relieve the congested stomach. The alkaline purgative salts, well diluted, are also of service. They may be frequently administered in very small quantities, as a tea-spoonful of iced liquid citrate of magnesium every ten or fifteen minutes. Equal parts of Hunyadi water and Apollinaris will often produce watery evacuations, with prompt relief of

the vomiting, but unless purgation is produced the vomiting will probably not cease. If the vomiting is due to the presence of gall-stones, of course the remedies directed to the relief of the foreign body are to be used. If the cause cannot be relieved, in addition to the blister and a selection of proper foods measures addressed to the stomach must be resorted to. The troublesome and persistent retching that attends "biliousness" and the passage of a gall-stone is relieved by lukewarm water, which causes free vomiting. Weak infusions of bitters, such as sage, produce the same effect. If there is undigested food in the stomach, an emetic must be administered. Washing out the stomach thoroughly with hot water, or with hot water in which boric acid has been dissolved in proper proportion, will often allay the vomiting. If these means fail, gastric sedatives are necessary. Small doses of morphine, given dry on the tongue, will often allay the vomiting. In combination with calomel its effect is even more marked—$\frac{1}{48}$ to $\frac{1}{24}$ grain of morphine and $\frac{1}{16}$ to $\frac{1}{12}$ grain of calomel administered every half hour. Bismuth is a useful sedative. It may be given in powder alone or combined with morphine, or the effervescing salts of bismuth may be used. Oxalate of cerium and hydrocyanic acid are also advised. Cocaine in doses of $\frac{1}{8}$ grain in solution or pill form very promptly relieves persistent vomiting in some cases. Creasote, administered in pill form, is also often of service, as is deodorized tincture of opium in doses of 2 or 3 drops every one or two hours, Alkalies are often of service, and bicarbonate of sodium or potassium or neutral mixture may be used.

Diarrhœa.—If the diarrhœa is associated with fermentation and the stools are very large and watery, it should be checked by astringents and antifermentatives. Creasote, carbolic acid, charcoal, and bismuth are often used. Alkalies, as bicarbonate of sodium alone or with pancreatin or liquor pancreaticus, may be given. Aromatic sulphuric acid in doses of 5 to 10 drops, well diluted, is one of the most serviceable astringents. Preparations of zinc, as the oxide, and of lead, as the acetate, yield good results. These remedies, if the secretion of the kidney is healthy, may be administered with opium and its preparations, or may be used alone. Diarrhœa will sometimes require purgatives to relieve it. This is particularly true if the stools are small and frequent and associated with dysenteric symptoms; alkaline purgatives, as large doses of sulphate of magnesium, are then required. Frequently relief is given by the use of a large enema given early in the day, which irrigates the colon. The water used should be hot, and an antiseptic may be dissolved in it, such as boric acid or creolin. Proper food must of course be selected.

Hæmorrhoids.—Hæmorrhoids are liable to be present in patients suffering from diseases of the liver. There is no contraindication to

surgical measures for their relief, except protracted jaundice, when hæmorrhage at the operation is likely to be excessive. We do not know whether prompt healing is interfered with by portal congestion, nor do we know whether local and general infection, in spite of antiseptic measures, is more liable to occur when the hæmorrhoids are due to intercurrent liver disease. In order to relieve them the bowels must be kept open. The patient should, if possible, have an evacuation in the recumbent posture, and a rectal bougie may be used with great comfort. After the evacuation the parts are to be thoroughly cleansed and disinfected. A small clyster of olive oil will give relief. If the bowels are not too constipated, a small amount of laudanum may be added to the oil. If the alkaline purgative waters do not produce evacuations of proper consistence, preparations of sulphur will sometimes provoke an easy movement, which gives great relief. The sulphur is to be used at night, either alone or in the combination known as compound licorice powder. Astringents, ointments, and washes are to be used when distressing symptoms arise.

Biliousness.

If premonitory symptoms prevail before the more acute symptoms arise, the attack may be averted by a saline purgative or an emetic. A glass of hot water in which Carlsbad salt has been dissolved will often clear the tongue and remove the bad taste in the mouth, particularly if proper food is taken and restriction in the duties of the day is carried out during the succeeding twenty-four hours. Podophyllin, $\frac{1}{4}$ grain, or a mercurial, as 5 grains of blue mass, at bed-time, may produce the same result. If, in spite of the measures indicated, which may be continued two or three nights, the acute symptoms develop, rest and quiet must be enjoined. Bland articles of diet, chiefly liquids, should be frequently administered in small quantities. Large draughts of lukewarm water will relieve retching, and the sipping of hot water stop the vomiting. Sinapisms to the epigastrium are of value. The excessive vomiting may also be relieved by carbonic-acid water or cracked ice. Effervescing alkaline waters are efficient if they are laxative. In minute quantities the effervescing salts of bismuth are of special advantage in some cases. As soon as purgation is secured the vomiting generally ceases. Often, sedative doses of calomel, just large enough to act upon the bowels, can be given, and $\frac{1}{8}$ or $\frac{1}{6}$ grain every half hour or hour, dry on the tongue, is generally efficient. It may be combined with small doses (1 grain) of subnitrate or subcarbonate of bismuth. In some cases with restlessness minute doses of morphine may be added. Indeed, $\frac{1}{16}$ to $\frac{1}{10}$ grain of calomel and $\frac{1}{48}$ to $\frac{1}{32}$ grain of morphine, dry on the tongue, is the

best remedy for vomiting the writer has used. If there is headache caffeine may be added to the calomel in ¼-, ½-, or 1-grain doses. Lately acetanilid has seemed to be of advantage. It does not nauseate, and in 1- or 2-grain doses soon relieves the pain. The purgative action of calomel may be aided by an enema or glycerin suppository.

Some patients crave an acid when suffering from biliousness. The aromatic sulphuric acid, in doses of 2 or 3 drops in a table-spoonful of aniseed-water or cinnamon-water given every half hour, will be found to be grateful. A drop of deodorized tincture of opium may be added, and augments the sedative effect of the acid. The foregoing remedies are of service after the bowels have been moved by a purgative or if a symptomatic diarrhœa attends the attack.

In some cases neutral mixture or the officinal solution of citrate of potassium in ½-ounce doses checks the vomiting. Equal parts of the latter and paregoric in a dose of 1 or 2 drachms is a favorite prescription with the writer.

Lime-water alone or added to milk is used frequently. Milk diluted with lime-water or carbonated water and administered in small quantities allays thirst and vomiting. Stimulants may be necessary. Small amounts of fine brandy or good rye whiskey added to lime-water, if iced, are often grateful. Champagne is also very good.

When the symptoms of biliousness are less acute and more protracted, the diet must be regulated in accordance with the principles of the dietetics of liver disease. The drugs to be used are those which increase the action of the liver and relieve portal stagnation by producing a movement of the bowels each day. Alkalies are the best, and the alkaline purgative waters or salines dissolved in large amounts of water soon remove the disagreeable symptoms. The writer usually selects phosphate of sodium, and has seen the state of biliousness removed by the use of this drug dissolved in hot water and sipped slowly at bedtime. In more severe cases it may also be taken in the morning before breakfast. Carlsbad or Saratoga Vichy salts in the same way are also of service. The vegetable hepatic stimulants may answer instead, and indeed have been of service when alkaline waters could not be taken.

It is of great advantage to combine an alkali with a vegetable cathartic, and in cases of biliousness in which the patient is liable to acute exacerbations bicarbonate of sodium and salicylate of sodium, alone or together, combined with rhubarb in tincture or with infusion of gentian, given before meals have been of service to the writer. The dose of rhubarb is such as to ensure one or two evacuations of the bowels each day. Instead of the bitter, for children an aromatic syrup may be used as the excipient. The writer is satisfied that an alkali administered in this way is of much service in cases of biliousness

which occur in persons of phlegmatic temperament who are overweight and leading a sedentary life without much strain or excitement.

The mineral acids are of decided advantage in biliousness, particularly if associated with abundant discharge of urates and uric acid. For this purpose nitro-hydrochloric acid and dilute hydrochloric acid have served the writer well. They should be given after meals, well diluted, and may be combined advantageously with a bitter, as nux vomica in small doses. It has seemed to the writer that persons of spare build, of dark complexion, engaged in a sedentary occupation with much worry, are best relieved by acids. They are also indicated, according to Ringer, if there is headache situated along the eyebrows.

At the same time, drugs which aid gastric and intestinal digestion or which allay the distressing symptoms must be used. Preparations of pepsin and pancreatin are required. The vegetable bitters or mineral acids, bismuth, carbolic acid or creasote, charcoal, and similar drugs, are to be used if indications require them.

Patients who can do so are always benefited by a course of waters at any good "cure," while a life in the woods, a sea-voyage, travel, or light occupation, if carried out in accordance with hygienic rules, removes all traces of sluggishness of the liver.

The administration of drugs is the least important element in the cure of biliousness. Attacks must be prevented and the tendency removed by a properly-regulated life. If the diet is selected in accordance with the rules previously indicated, it will aid much. Proper exercise must be taken, occupation inquired into, hours of work and rest regulated, systematic bathing directed, and, in fact, the life of each day conducted in a strictly hygienic manner. In children the best results are seen if the patient is properly managed. In accordance with the foregoing their life must be regulated, and in addition the proper development of all the functions should be aided. Their muscular system must be developed and the skeleton strengthened. Proper attention must be given to the eyesight. Often the evolution of the naso-pharyngeal structures is overlooked. An excess of lymphoid tissue, as seen in adenoid growths in the naso-pharynx, interferes with development, curtails breathing, requires hurried eating, and hence disturbs digestion and interferes with nutrition. In the writer's hands the removal of such growths has been followed by as striking results as are seen when proper glasses are fitted to a sufferer from a refraction error. Outdoor life, bathing, gymnastics, exercise, and proper food and hours for sleep will produce remarkable changes for the better.

Fatty Liver.

Fatty degeneration of the liver dependent upon disease of other organs requires for its treatment the relief of such disease if possible,

or an attempt to counteract the debilitating effects of the disease. The general health of the patient demands attention, and with the removal of the cause, tonics and stimulants and out-door life, with well-regulated, highly-nutritious diet, and all measures to promote the general health, must be resorted to. Fatty infiltration of the liver, or the fat liver, as it may be termed, like the fatty heart, is usually associated with general obesity and an increase of fat in other organs. The presence of fat in the liver is not as serious as its presence in other situations; as, for instance, in the heart. The treatment, therefore, of fatty liver is the same as advised in the treatment of obesity, the method selected being dependent upon the cause of the obesity and the condition of the heart and arteries of the patient. The methods of Oertel, Banting, Ebstein, Schwenninger, and others are of avail. In the use of these methods reduction of the amount of food is insisted upon and plenty of exercise ordered. Oertel also reduces the quantity of fluids. All of these authors allow a mixed diet, with the exception of Banting, who orders an exclusive albuminous diet. Ebstein permits the fats to be taken, but requires a reduction in the starch and the saccharine foods. In proper cases purgatives may be used, and especially in the form of mineral waters. Oertel, however, advises against the use of the Carlsbad waters or the "cure" at Carlsbad. The Marienbad waters are advised by Kisch, but it is to be remembered that an anæmic patient would be prostrated by such a course, while a plethoric one would be improved. Graduated exercise, of course, must be allowed, the amount dependent upon the condition of the heart. Such exercise gradually strengthens the heart-muscle and increases its function. In grave cases it should be attempted only in the strictly accurate manner laid down by Oertel. The circulation in the right heart and pulmonary vessels is increased and the general circulation benefited thereby. The portal circulation, particularly, would be stimulated by proper exercise by gymnastics and properly-directed massage. Drugs are not of much service. Preparations of arsenic may be used, and iron, if the patients are anæmic, is always of service.

Congestion of the Liver.

Active hyperæmia of the liver is seen more particularly in hot climates. It follows the abuse of stimulants. Rich food and alcoholic drinks must be avoided, and checking of the perspiration prevented. A repetition of the attack, so liable to take place, can be prevented by these means. The diet must be simple. Milk, broth, beef-essence, and the most easily digested semi-solids must be employed. Active hyperæmia, if attended by pain, may require local bloodletting, as by cups or leeches. The latter may be applied to the anus. Deple-

tion can sometimes be secured by active purgation with salines. A warm bath at the time of the attack is of service. Sinapisms, followed by large poultices of flaxseed or cloths wrung out of hot water, with or without turpentine, give great comfort. Some internal remedies appear to relieve the congestion. Alkalies, chloride of ammonium, and ipecacuanha are highly spoken of. Mercurials are not resorted to. Effervescing alkalies may be administered before meals with a weak bitter infusion. Bicarbonate of sodium, with taraxacum, is often prescribed, and Carlsbad, Vichy, and Bedford salts are valuable. Chloride of ammonium is considered by some almost a specific. Large doses are administered frequently, and in twenty-four or forty-eight hours the acute symptoms disappear. Ten grains of the drug may be given every two hours, largely diluted, or 20 grains at intervals of four hours until six doses have been taken, when the amount may be reduced. McLean has called attention to the value of ipecacuanha. Large doses alone are of service; 15 to 30, or even 40, grains are administered, care being taken not to provoke emesis. In order that this may be prevented, the patient should lie down and precede the doses of ipecacuanha by 10 drops of deodorized tincture of opium, and at the same time a mustard plaster should be applied to the epigastrium. The ipecac should be repeated in three hours, and after the second dose relief is usually secured. If not, a third dose may be taken.

Chronic Congestion or Chronic Hyperæmia of the liver requires treatment with two objects in view: first, to remove the cause; and second, to deplete the engorged liver. In order to secure the first, the circulation must be carefully studied. Lesions of the heart which produce venous stasis must be overcome if possible: digitalis is therefore to be used in full doses until the dilated heart responds to treatment. Other cardiac tonics are likewise of service. Saline cathartics, as the sulphate of magnesium or the saline purgative waters, must be judiciously administered. The congestion may be due to disease of other organs within the abdomen or arise from the pressure of growths or hypertrophied organs. If possible they should be removed. Malarial congestion requires for its treatment the use of proper antiperiodics, of saline purgatives, counter-irritation or frequent cuppings, and even occasional leechings, over the liver or about the anus. A certain amount of anæmia is frequently present, and must be treated in the usual way. Arsenic meets several indications when used cautiously: the chronic malaria, the poor digestion, and the weak heart are benefited. The general indications concerning diet and exercise previously mentioned must be carefully attended to. When congestion of the liver is followed by atrophy or by the "nutmeg" liver, symptoms of portal obstruction arise, as in cirrhosis.

The treatment detailed in the section on the latter disease and in the discussion of Ascites, etc. is applicable to atrophy and "nutmeg liver." Pigment liver is due to congestion, with deposition of hæmatin in the vessels and secondary interstitial hepatitis. The treatment is evident from what has already been said.

Amyloid Degeneration of the Liver.

There are no drugs which have any influence on amyloid degeneration, although at one time it was thought that alkalies administered freely had a decided effect upon the condition. The cause must be combated in the management of amyloid disease, and its baneful influence removed if possible. Suppuration must therefore be checked, bone diseases treated actively and as early as possible, and syphilis and tuberculosis treated in accordance with the well-known methods for their limitation. It should not be forgotten by surgeons who hesitate in the performance of operations that the continuance of chronic suppuration or of any chronic necrotic process is liable to be attended by amyloid degeneration. Imminent danger from this cause, therefore, urges to early operation.

Iodine is said to be of service in amyloid disease. Murchison advises the administration of the tincture in doses of 10 or 15 minims, diluted, three or four times a day. No doubt cases of amyloid disease are benefited by this drug, but it is not likely that the degenerative process is checked.

The general rules regarding diet, habits, and exercise that pertain to all forms of hepatic disease must be enjoined, as far as practicable.

In the course of amyloid disease of the liver complications will arise and demand attention. The disease is likely to cause most obstinate vomiting and excessive diarrhœa, both of which are difficult to control. For the vomiting counter-irritation over the epigastrium may be used, and bismuth and hydrocyanic acid administered internally. Cocaine appeared to be of service in one of the writer's cases. Whether to check the diarrhœa or not is always a problem, because albuminuria is generally present. Opiates must be used under these circumstances with great caution, and even with care uræmia may occur. Large doses of bismuth and aromatic sulphuric acid may be given, and hot fomentations and counter-irritation used upon the abdomen.

Hydatid Cysts of the Liver.

The treatment of hydatid cysts is preventive, symptomatic and curative. Care should always be taken by those who are among dogs and other animals to avoid contracting the disease.

The symptoms which require relief are usually due to pressure or

to local inflammation, indicated by pain. In multiple hydatid cysts, jaundice and ascites are the symptoms which demand the attention of the therapeutist.

At one time it was thought that medicine by the mouth would cause destruction of the parasite, followed by absorption of the cyst. Chamomile alone or with bromide of potassium was advised; turpentine was administered by others; iodide of potassium has been vaunted; and Davine thought he obtained some good results from salts of mercury. The argument against the administration of drugs is that by disturbing the intestinal canal risk of rupture from vomiting or diarrhœa is increased.

It does not seem probable that internal remedies can be so absorbed and taken up by the cyst as to influence the life of the parasite. If any curative treatment is advisable, operative measures of some form should at once be decided upon. Various method are advocated, but tapping and free excision have the support of most men of experience. The injection of medicated fluids and the use of electricity are not without advocates. Tapping may be done with a trocar and canula, or by means of aspiration with the Dieulafoy apparatus, which is usually employed. The advocates of puncture of the cyst believe that it is the simplest method and attended with the least danger. Of course if suppuration has taken place in the cyst no cure can be brought about simply by tapping or aspirating. Surgeons who oppose tapping or the use of the aspirator believe that serious results sometimes follow this method. There is no doubt that in a measure one is striking in the dark when the needle is plunged into the region in which a hydatid cyst is situated.

Graham in his recent work on *Hydatid Diseases* relates a number of cases which died a short time after tapping. In one case the cause of death could not be found at the post-mortem examination; in another, sudden cough on the introduction of the needle led to rupture of the cyst into the lung, with hæmorrhage which filled the whole left lung. In two of his patients tapping had to be immediately followed by free incision, because of the onset of alarming symptoms. It is fair to state that in both these cases the cyst was in the lung. Graham states, however, that he has frequently noticed, after evacuating an abdominal hydatid, troublesome and intense symptoms, such as vomiting, severe pain, high temperature, and a rapid pulse persisting for several days. He does not believe that this is due to peritonitis, but that either absorption of the fluid had taken place or else the symptoms were reflex in their character. In the very limited experience of the writer aspiration with antiseptic precautions was not followed by grave symptoms, and resulted in cure in two patients, a child and an adult. It is thought that in the process of cure after tapping the cyst-walls

collapse and fall away from the adventitia; an exudation of serum then takes place as the new cyst forms, while the cyst-wall becomes a suppurating mass, breaking down into an amorphous débris. Some authors believe that it is necessary to evacuate only a small amount of fluid.

Graham advises the physician not to allow the patient to go out of his care until some time has elapsed, as there is danger of suppuration. Fagge recommends that a year of quiet should elapse after the cyst has been tapped, in order that suppuration may not be set up. It has just been mentioned that it is uncertain what is touched by the exploring needle when it is introduced in the hepatic region. The dangers that may arise from tapping are increased often because of the difficulty of localizing the cyst. The cyst may be either directly beneath the diaphragm, behind the pendent lobes of the liver, or in the median line near the suspensory ligament. For these reasons, while exploratory puncture in certain regions is simple and apparently free from risk, tapping operations are not to be generally advised in the treatment of hydatid disease.

Direct incision and evacuation of the contents of the hydatid is certainly the most rational method of treatment. The operation is performed as are other abdominal operations. Lindemann is said to have performed the first operation in 1871. He stitched the cyst-wall to the abdominal parietes, and his patient made a rapid recovery. Tait makes an abdominal incision, aspirates the fluid, then opens the cyst, and stitches its edges to the external wound. Simons operates differently. He first inserts a fine trocar and canula, and withdraws the canula to verify the diagnosis. He then inserts a larger instrument, which allows some fluid to escape. He keeps this in position, and applies an antiseptic dressing. The plugs in the canula are removed at intervals of a few days in order to study the character of the disease. As soon as pus is found inflammatory adhesions have resulted, and he then cuts directly into the cyst. This method is tedious, and even uncertain as a means of procuring adhesions.

If the direct incision is decided upon, the most prominent part of the tumor is selected, and an incision two inches long is made to the surface of the peritoneum. The further technique is the same as the operation for ovarian tumors, care being taken to attach the edges of the cyst to the abdominal incision and not to allow fluid to escape into the abdominal cavity. After the cyst is stitched to the wound it is opened with a knife and the finger inserted. The contents are thoroughly evacuated and the daughter-cysts are removed by curetting. The cyst must be completely emptied. Anything like force must be avoided, as bleeding may result from the pericystic connective tissue. After the contents are evacuated a drainage-tube is

inserted and the wound dressed antiseptically. The method of direct incision has also been performed in two parts: First incise down to the peritoneum and plug the wound with serum gauze. In about a week adhesions are formed. The cyst is then opened with a knife, as in Lindemann's operation. Barwell has advocated this method in England. Graham argues that it has no advantage and necessitates the shock of two operations, while adhesions are not always procured. Cysts that grow on the upper surface of the liver must be reached by removing the ribs at the most dependent part. Care must be taken not to allow fluid to escape into the pleural cavity. Usually a counter-opening must be made in order to favor drainage. The cyst after operation should be frequently syringed with a few drops of iodine and water or a bichloride-of-mercury solution, care being taken not to inject the fluid forcibly.

An article by Fagge and Durham in 1871 called attention to the use of electricity in the treatment of hydatid cysts, but the report of their cases in which complete cure was claimed has not been followed by enthusiastic reports of other operators. The needles were electro-gilt and introduced into the cyst a few inches, and were made to touch each other when inserted. The negative pole of the galvanic battery was attached to the needles, while the positive pole terminated in a sponge, which was rubbed over the tumor. The current was allowed to pass for ten minutes. The advocates of this treatment believe that the saline solution in the cyst is decomposed, and that the parasite in consequence loses its vitality.

A large number of materials have been injected into the cysts. Iodine seems to have been the favorite, carbolic acid next, and finally a solution of bichloride of mercury and carbolic acid. Power recommended a mixture of ½ drachm each of fluid extract of male fern and liquor potassii. Batchelli used a strong solution of bichloride of mercury, and permanganate of potassium is said to cure cases of hydatid cyst with daughter-cysts if injected into the cavity.

Acute Yellow Atrophy of the Liver.

This peculiar affection, rare and always fatal, is unfortunately of no interest to the therapeutist who is anxious to secure good results. There are no remedies or methods of procedure which will stop the progress of the disorder or even relieve any of the symptoms. Whatever treatment is used must be entirely symptomatic. The vomiting that occurs will require attention; hæmorrhages may be checked; if possible the pain, which sometimes is complained of, relieved in a partial manner; and exhaustion and prostration treated by stimulants. In pregnant women it is barely possible that the induction of labor might be of service if performed sufficiently early, and yet the dangers from uterine

haemorrhage would make the procedure most grave. If the blood should not show much reduction in the number of red corpuscles and the operation were resorted to early, it might be of service. If the red blood-corpuscles are destroyed, certainly fatal haemorrhage will ensue, and therefore it is scarcely worth while to interfere. Attempts might be made also to invoke the action of the skin, and thereby relieve the congested and degenerated kidneys. The renal organs should also receive attention and their functions be excited if possible by cups and fomentations. The cases which the writer has seen did not respond to any treatment whatsoever, except that pain was relieved apparently by anodynes. Of course these cases have led the writer to insist upon the induction of labor as soon as the diagnosis of acute yellow atrophy of the liver is made, with the hope that by removing the predisposing factor of pregnancy life may be saved.

Acute Localized Hepatitis or Abscess of the Liver.

Multiple abscesses of the liver, pyaemic abscesses, or emboli and tropical abscess will be considered together. Although, in accordance with our classification, they belong to another section, space is saved by considering them here. Pyaemic abscesses are not curable The symptoms which accompany the affection alone can be treated. Pain and tenderness must be relieved by local applications of heat; large poultices or hot cloths will be found to be of comfort. Anodynes must be used in accordance with the circumstances of the case. Jaundice generally does not require much treatment, as it is often due to a morbid condition of the blood. If the inflammation is due to the presence of gall-stones, the jaundice is more intense, and is to be treated in accordance with the principles laid down in an earlier part of this article. For the constitutional symptoms quinine and the mineral acids are to be used. Stimulants of course will be necessary. Other symptoms that arise, such as vomiting and diarrhœa, will require attention. The diet must be nutritious and abundant.

Even in cases of multiple abscess surgical methods of relief are sometimes necessary. Aspiration may be required with the hope of relieving symptoms; permanent good would, of course, not ensue. Multiple abscesses that result from dysentery should not deter one from an operation. If the operation is properly done and proper drainage secured, it will do no harm and may result in cure. The presence of two or more abscesses does not necessarily compel us to withhold our hands, as any number may be operated upon and drained simultaneously.

Tropical abscess of the liver requires treatment differing in character in the two stages of the disease. In the first stage the treatment is not unlike that of congestion of the liver. Dietetic and hygienic meas-

ures must be employed. Local applications and remedies for the relief of pain are to be given, such as chloride of ammonium, ipecacuanha, and saline aperients. They are administered by the methods advised in congestion of the liver. Should the congestion of this form of hepatitis not be relieved and suppuration take place, a different plan is required. The pain and local discomfort will require local applications of heat and moisture and the use of sinapisms or blisters. The fever must be treated in accordance with the usual methods for the treatment of hectic, and the strength of the patient must be kept up. Nutritious food, not too stimulating, must be given, and quinine and the mineral acids used. The presence of pus can be accurately determined only by the aspirator.

Puncture of the liver for this purpose is not generally attended with danger. A long, fine needle attached to the end of the ordinary aspirating apparatus of Bowditch or Dieulafoy may be used. The puncture should be made at the most prominent or swollen part, particularly if it is œdematous. When on the right side, the needle should be thrust upward to the left; and if in the left side, its point should be directed obliquely to the right. The needle should then be withdrawn slowly. If pus is present, a drop or two will be found in the canula or on the point of the needle. The absence of pus does not necessarily signify the absence of an abscess. Sometimes the material forming the abscess is so thick that it will not become attached to the exploring needle, or the abscess may not have been reached. Repeated punctures are not harmful, and may be required before the question of abscess is definitely settled. Instead of harm being done, there are quite a number of cases on record in which the symptoms were benefited by puncturing. If pus is obtained, further procedures will depend upon the position of the abscess and its size. If near the surface and of large size, it should be opened freely with the usual antiseptic precautions. An antiseptic solution should be used to wash it out and proper drainage instituted. If the abscess is presumably very deep, in opening it the danger of hæmorrhage from the tissue of the liver must be considered. In these cases it is probably better to aspirate with a large canula, through which drainage material can be conducted to the wound. Such aspiration should not be performed if the abscess can only be reached through the pleura behind. Under these circumstances it is better, after cutting down on the pleura, if adhesions have not formed, to stitch it by a double row to the diaphragm and then open freely with a bistoury. If the abscess is anterior, adhesions of the peritoneum to the liver are of advantage; if not present, the walls of the abscess could be stitched to the peritoneum and then opened.

If the abscess has ruptured into the lung or pleura, or, in fact, into

any of the neighboring structures, it should be opened and drained as early as possible. If there seems to be deep-seated suppuration which is not likely to open into important parts, and if the patient is not losing ground, the surgeon may wait a few days until the pus is in a more favorable situation. Otherwise, as soon as the presence of pus is determined the operation for its removal should be done.

Cirrhosis of the Liver.

No doubt the early stages of this disease are amenable to treatment if the habits of the patient are fully under the control of the physician. In all probability the stage of congestion which is thought to precede an overgrowth of the connective tissue may be removed. Treatment with this end in view is similar to the treatment of congestion of the liver. In addition to regulation of diet and habits, the use of alkaline, purgative, and diuretic waters is recommended; occasionally local depletion is used. The administration of iodide of potassium is looked upon with favor by some. Chloride of ammonium, administered in large doses, is also useful, and often the enlarged and congested liver, the first stage of cirrhosis, which is indicated by the habits and associate symptoms, diminishes rapidly when this drug is administered. Some practitioners give small doses of mercury, while others advise external applications of the drug. The green iodide of mercury, administered three times a day in $\frac{1}{2}$-grain doses, appears to act as a resolvent according to the testimony of some authors, and at the same time relieves the overloaded portal circulation.

The writer has full confidence in the importance of stopping the use of stimulants and in depletion. He is not, however, satisfied as to the curative effects of iodide of potassium, although, as it is advocated by high authorities, the drug should be given a fair trial. It may be administered by the method indicated in the section on the Administration of Drugs. A course of waters at Carlsbad or Vichy, at Bedford or Saratoga, with a proper regimen, may relieve the first stage. The course should be repeated annually for a few years. If the disease has gone on to the stage of overgrowth of connective tissue, there are no remedies of any service. The measures resorted to must have for their object diminution of the congestion which is present, thereby avoiding further proliferation of connective tissue. Dietetic means, of course, are necessary to bring this about. The liver must be relieved from the performance of its functions as much as possible, and hence starchy foods, sugars, and fats must be diminished in amount or withdrawn entirely. Stimulants or highly-seasoned dishes of course are not to be allowed. In order to reduce the congestion, the portal circulation must be relieved by means of alkaline purgative waters, as Carls-

bad water, Hunyadi water, Friederichshall water, and the Saratoga or Bedford water of this country. If after these measures the disease progresses, attention must be paid to the congestion in the portal area of the circulation, and measures used which will lessen the deleterious results of such congestions in the abdominal viscera. In the earlier sections of this article the treatment of these congestions was referred to.

The gastric and intestinal catarrh, the gastro-intestinal hæmorrhages, hæmorrhoids, and ascites, are treated in cirrhosis of the liver just as they are treated in other affections of the organ in which the portal circulation is obstructed. The condition of the skin and kidneys must of course be looked after most carefully. Tonics and measures to keep up the strength of the patient are required. The mineral acids, quinine, nux vomica, and other bitter tonics, serve a good purpose, and in the course of the disease may be alternated from time to time. In the later stages of the disease it is necessary to administer stimulants. Prostration is so great and digestion so poor that without stimulating the mucous membrane of the stomach digestion cannot be carried on, while the prostration of course cannot well be relieved by other means. It is necessary, therefore, to relax the regulations regarding the use of alcohol, and spirituous liquors or wines must be ordered. Any one who sees a case through a long period of time will readily understand how necessary it is to administer stimulants in the later stages.

In the latter stages of hepatic cirrhosis a cachexia develops which requires most careful hygienic treatment, including the use of stimulants. In the cachexia the nutrition of the skin particularly suffers. It should be kept well oiled, as it is liable to become dry and scaly, and bed-sores or low-grade inflammations and ulcers are likely to develop. Pressure-points must be kept dry by powders and stimulated by friction. Cleanliness of the patient must be insisted upon, and local inflammatory areas prevented by proper bedding and clothing. As a summary of the treatment of cirrhosis of the liver we may say that the following measures are necessary: regulation of the diet; attention to the functions of the skin and kidneys; treatment of symptoms due to portal congestion; attention to gastric and intestinal digestion; an occasional use, therefore, of calomel associated with bitter tonics, particularly after indiscretion in diet or work, when the tongue becomes heavily coated, the appetite is lost, bowels costive, and stools clayey; and the administration of the mineral acids, bitter tonics, and stimulants when indicated.

Syphilitic hepatitis is to be treated in accordance with methods established for the treatment of the latter stages of syphilis. The iodides are to be given freely, alternating with or combined with tonic courses of mercury. Tonics are to be used when required. Proper

diet is to be selected and general hygiene regulated. Tubercular hepatitis or tuberculosis of the liver does not require treatment directed to that organ particularly.

Leucocythæmia will be considered elsewhere in this volume.

Thrombosis of the Portal Vein.

If occlusion of the portal vein occurs, ascites and congestion of the vessels in the gastro-intestinal tract, with subsequent catarrhs, hæmorrhages, and other symptoms of portal congestion, are also present. Treatment which ameliorates the symptoms should be resorted to: to remove the cause is scarcely to be hoped for.

If suppuration exists, efforts should be made to lessen its effects by tonics and stimulants. Otherwise, drugs will not be of service, and may prevent the good results of stimulants, food, and rest.

Acute Catarrhal Inflammation of the Gall-ducts.

At the beginning of an attack of acute catarrh of the gall-ducts liquid food that is not stimulating is required. Diluted milk or milk and lime-water, peptonized milk, whey, buttermilk, beef-tea, animal broths, and "slops" generally are required. As the attack subsides more solid food may be used. Oysters, white meat of chicken, a finely-minced steak made into a paté, and broiled sweet-bread, gradually passing on to other meats, eggs, fish, and easily-digested, succulent vegetables, may be used.

The patient should be put to bed and kept warm. Warmth should be applied particularly to the extremities. Mustard plasters, or even more active counter-irritation, to the epigastrium and right hypochondrium are necessary.

Sedatives to relieve vomiting, as in biliousness, are to be used. Calomel or alkaline draughts to secure purgation should be given in the first twenty-four hours. The bile is retained in the liver by a very slight obstacle. The pressure which causes it to pass out in health is very small; if this pressure be increased, the plug of mucus or other obstacle in the biliary canal may be removed. An emetic will have this effect. A sufficient dose of ipecacuanha or $\frac{1}{4}$-grain doses of tartar emetic, given every hour in a large amount of hot water until emesis is produced, will often relieve the obstructive jaundice.

Drugs which liquefy the bile and at the same time increase secretions from mucous membranes or dissolve mucus are indicated. Of these, phosphate, bicarbonate, benzoate, and salicylate of sodium are the best. At first the drug which is used may be combined with calomel in small doses, and afterward given alone freely diluted. Alkalies may be given with taraxacum in decoction or in pill or capsule, followed by large amounts of hot water. Chloride of ammonium is another

drug of great service: 5 grains every two or three hours, masked by licorice or by simple syrup, may be given. It can also be given in capsule, compressed pill, or cachet. If the bowels have been freely opened and the jaundice does not show signs of disappearing, nitrate of silver may be used. It should be given in pill form and on an empty stomach.

Ipecacuanha in small doses as an hepatic stimulant is advised by many writers. It should be given after the nausea and vomiting of the first period of the attack have passed off; $\frac{1}{4}$ to 1 grain every two or three hours is sufficient. It may be combined with nitrate of silver if that drug is given. Hydrastis is much employed in certain parts of this country under similar circumstances. In more protracted cases nitric acid is often of service, and the acid pack over the liver or the general acid bath may be used. The method of Krull has been advocated during the past five years, and the writer has observed some cases that were rapidly relieved by it. From 1 to 4 pints of water, at a temperature of 59° F., are slowly injected into the rectum once daily. It must be retained as long as possible. On subsequent days the temperature of the water is gradually raised until it is injected at 72° F.

Other methods for the relief of the jaundice have been advised. When the gall-bladder is enlarged and accessible, its compression must be very gradual, and in some cases the patient improves by relief to the obstruction and hence diminution of the inflammation. Some high authorities recommend faradization of the gall-ducts.

It is not to be forgotten that some cases of acute catarrh of the ducts are of malarial origin, and require quinine and arsenic.

Catarrhal inflammation of the ducts, if due to syphilis, must be treated accordingly. Often it is of gouty or rheumatic origin, and in such cases Murchison recommends the use of colchicum in addition to alkalies in suitable doses.

Chronic Catarrhal Jaundice.

In cases of chronic catarrhal jaundice proper dietetic and hygienic regulations are to be ordered. Malaria, heart disease, or any removable cause must be attended to. Mild counter-irritation should be used. Hot water in large amounts, or Carlsbad, Saratoga, or Vichy water, may be given.

Phosphate of sodium and chloride of ammonium must be given for a long time. The prolonged use of the nitrate of silver seems to be of the greatest value. The extract of belladonna may be added, and $\frac{1}{8}$ to $\frac{1}{4}$ grain of each given before meals.

The mineral acids and the acid pack are advised by many, and their use has been followed by cure. This variety of jaundice receives bene-

fit at springs and baths. The waters of Carlsbad, Marienbad, Vichy, Saratoga, and Bedford are almost always beneficial in cases of uncomplicated chronic catarrh of the ducts.

Adhesive Inflammation of the Bile-ducts.

Adhesive inflammation of the ducts, with or without stricture, which has followed the passage of a gall-stone or the healing of an ulcer, can only be treated symptomatically. If the gall-bladder is enlarged, it is possible that the stricture is below the cystic duct, and a cholecystotomy or cholecystenterostomy may give relief by establishing an outlet for the bile.

Occlusion of the Gall-ducts.

If the cause of occlusion of the ducts can be ascertained, its removal, if possible, is necessary. The removal of gall-stones will be considered in another section.

Acute and suppurative inflammation of the ducts can only be treated by removal of the cause. If a gall-stone or other foreign body has excited the inflammation, its removal with proper drainage will cure the patient. Otherwise, the pain, hectic fever, and jaundice can only be treated symptomatically.

It is to be remembered that such occlusion may sometimes be due to the pressure of accumulated faeces in the colon.

Carcinoma.

In this outline of diseases carcinoma is placed under Diseases of the Ducts. Primary cancer without doubt always originates in the ducts. The secondary variety does not differ in symptoms from the primary.

A few words only are necessary in the discussion of the treatment of cancer and other tumors of the liver. The treatment is that of the complications, of which local hepatitis, gastro-intestinal congestions, ascites, and jaundice are the most important. The pain will demand local counter-irritation, occasional blisters, and the internal use of opium. The remaining complications are discussed in other sections.

Gall-stones.

A discussion of the treatment of a patient subject to gall-stones must include—first, the treatment of the habit which predisposes to their formation (cholelithiasis); secondly, the treatment of an attack of biliary colic; thirdly, the treatment of the stones in the ducts or bladder —(*a*) when free from symptoms; (*b*) when they cause occlusion of the biliary passage or set up suppurative inflammation.

In order to prevent the formation of gall-stones, dietetic and other hygienic means are necessary. Fatty and saccharine articles of food,

rich food, and malt liquors must be interdicted. Exercise in the open air must be insisted upon, especially such forms as increase the strength of the abdominal and respiratory muscles.

If the patient's occupation is sedentary he should change his position frequently. Sitting and standing should alternate. In women particularly improper habits of sitting should be corrected, and the wearing of corsets and other tight clothing forbidden. If by reason of some other ailment they have not taken exercise sufficient for the wants of the body, the ailment of course should be first corrected: this refers more particularly to uterine disease. In many cases it is quite necessary to teach patients how to exercise, or rather to make them appreciate how little exercise they really take. It is surprising how, through the force of long habit, many women will be content to keep in-doors, and, practically, almost in one position. Indeed, the physician must preach the gospel of exercise, diet, and general hygienic care in cases of this character, as in many others, with an enthusiasm equivalent to that needed, as many think, for the saving of souls.

The bile should be made thinner and its movements through the ducts hastened. To secure the former, large quantities of water should be taken. It should be very hot and swallowed slowly and at night. Carlsbad Sprudel salts dissolved in the water, the Vichy or Saratoga salts, phosphate or salicylate of sodium, are important and almost essential adjuncts. If the patient is constipated, the above-mentioned salines and alkalies are particularly necessary, and may be used with other purgatives and hepatic stimulants. The use of alkalies not only prevents the formation, but seems to dissolve or aid in the dissolution, of the concretions. In order to secure a discharge of bile the characters of which do not favor the formation of calculi, the long-continued use of salicylate of sodium is advised.

For the class of cases under discussion a course at the saline springs is of great advantage. If the patient is careful subsequently, the formation of the stones may be permanently prevented. The springs should be selected in accordance with rules previously indicated; suffice it to say that the Carlsbad and Vichy abroad, and the Saratoga and Bedford in this country, are the best.

Biliary Colic.—The passage of gall-stones always requires medical attention. Pain and collapse, vomiting and perhaps jaundice, are the symptoms demanding relief.

For the pain local applications—poultices, hot cloths, the hot-water bag, and mustard plasters—are useful. Local depletion is not necessary unless a local inflammation arises. The general hot bath may give great relief through the relaxation it produces, whereby the passage of the stone is favored.

Opiates are generally necessary; morphine may be administered by

the mouth or by hypodermic injection. If given hypodermically, atropine may be added to it with great advantage; ¼ grain of morphine and $\frac{1}{120}$ grain of atropine in a robust subject will be sufficient. The injection may be repeated in half an hour. The morphine should be given by the mouth in small and frequently-repeated doses unless the pain is excessive. Opium may also be given by the rectum, either by suppository or enema—½ grain of the extract—and the same dose of belladonna gives relief. Ringer advises gelsemium; 5 drops of the tincture are to be given every fifteen minutes. If the patient walks about, relief may follow sooner.

If the above-mentioned drugs are not sufficient, inhalations of chloroform or ether may be required. Neither of these drugs can be given internally, on account of vomiting.

To relieve the pain and favor the passage of the gall-stone, sipping hot water made alkaline with bicarbonate of sodium may be of advantage.

Vomiting is a most distressing symptom. It may not be relieved until the full effect of the anodyne is produced. Alkaline waters, hot or effervescing, are of advantage. Cracked ice in small particles may be swallowed, and measures suggested in the preceding section tried.

If the stone does not pass through the common duct—which may be determined by an examination of the stools—it will remain either in the gall-bladder or in one of the ducts. In this situation no symptoms may indicate its presence, but it is desirable to get rid of it and prevent the formation of others. The methods to prevent the formation of stones have been described. To remove existing stones, solvents, as chloroform and turpentine, have been used, but they are not worthy of further trial. More can be expected from alkalies and salines when largely diluted and hot, combined with a regimen of diet and exercise like that followed at Carlsbad. It is thought that olive oil, in ½-ounce or 1-ounce doses three or four times a day, will move the calculus. Particles of fat in the stools must not be mistaken for cholesterine bodies. If a solitary stone remains in the gall-bladder or duct, gentle compression on the enlarged gall-bladder may cause its expulsion.

If, in spite of these measures, the stone is fixed and grave symptoms of obstruction arise, surgical measures must be resorted to.

DISEASES OF THE SPLEEN.

WITH rare exceptions, affections of the spleen are either secondary disorders or occur conjointly with diseases of other organs. The spleen

may be the seat of acute or chronic congestion or inflammation, of infarction, of lardaceous degeneration, of carcinoma, and of hydatid disease. Hypertrophy of the spleen is frequently seen, but is almost always associated with leucocythæmia, the treatment of which is discussed in the article on Diseases of the Blood.

As the affections of the spleen are usually secondary, the reader must look to the appropriate articles for an account of the therapy of particular diseases. It is sufficient to say that the therapeutic management of affections of the spleen is not dissimilar to the management of similar affections in other organs. The removal, if possible, or treatment, of the cause is primarily to be attended to. Then hygienic measures or therapeutic methods are to be used which will lessen congestion of the organ, and hence congestion or over-fulness of the portal circulation must be removed. Congestions and inflammations, which often result in suppuration, degenerations, and other processes, require the local and general treatment applied to such morbid processes.

It may be worth while to remark that in acute affections of the spleen—acute congestion, acute inflammation, and recent infarcts—the organ should be manipulated with the utmost care and as infrequently as possible. Rupture has been known to occur from too careless and energetic palpation.

Acute congestion, present in fevers, may require anodynes and local applications to relieve the pain and sense of distension which are present. Depletion, locally with cups or leeches, or by saline purgatives, may be required, and the abdomen may be surrounded by a firm bandage to secure support. Acute swelling or acute congestion attendant upon or following miasmatic disorders is reduced as soon as the causal disease is controlled by quinine, arsenic, etc.

Passive congestion of the spleen due to cardiac disease or secondary to disturbances of the portal circulation requires remedies which control or modify the original disease. In addition to cardiac and vascular tonics, the saline purgatives must be administered cautiously, and mineral waters which relieve portal congestion are to be taken freely.

If long continued, passive congestion is attended with hypertrophy of the organ, due to overgrowth of the connective tissue. The treatment of such hypertrophy includes, first, the treatment of the cause; secondly, the use of tonics and stimulants; thirdly, salines and other cathartics to deplete the portal circulation; fourthly, the external application of stimulating liniments; and finally, the use of drugs externally which act as absorbents. The stimulating application most in favor is iodine. It may be used in the form of either the tincture or ointment. The best-known remedy, which has had a long-established reputation for its resolvent properties in this disease, is mer-

cury. Stillé advises that mercury be not administered in cases of enlargement of the spleen which have arisen in the course of hepatic disease. He refers to the papers of Twining, Crane, Vetch, Abercrombie, and others in support of this opinion, and insists that cinchona and iron should be given alone. McLean, who has had a large experience in the hospital at Netley, advises the use of an ointment of biniodide of mercury. The ointment should be rubbed into the skin of the splenic region for about ten minutes; the patient should then be exposed to the heat of a fire. This application may be made daily until the surface is irritated by the ointment, when it must be withheld until the irritation has subsided. Care must be taken to prevent salivation. Some authorities advise the use externally of cloths saturated with dilute nitro-hydrochloric acid. The compress when applied should be kept in place by a broad bandage, and should be changed every two or three days. Recently, injections of various drugs directly into the tissue of the spleen have been advised. Mosler has used, with apparently favorable results, tincture of iodine. Pepper strongly urges the hypodermic use of ergotin or of ergot in the form of the fluid extract. While benefit has been apparently derived from the use of drugs in this way, the writer believes that the hypertrophy, if reducible at all, can be reduced by other and safer means, and that the risks attendant upon injections into the spleen do not warrant their use.

Acute inflammation or abscess of the spleen is exceedingly rare, and can be recognized only with great difficulty. It is to be treated symptomatically. Pain is to be relieved by poultices or hot fomentations and by the use of anodynes. The general symptoms of such inflammation are to be treated as in inflammation of other organs. Operative methods have not been resorted to on account of the difficulty of diagnosis. Inflammation of the capsule is to be treated like localized peritonitis in any other portion of the abdomen. Blisters, poultices, and anodynes are required. Chronic inflammation of the spleen with enlargement is to be treated in accordance with the methods described under Passive Congestion.

Hæmorrhagic infarcts are presumably present when with an evident predisposing cause the spleen is found to be enlarged, painful, and the seat of tenderness. Sometimes an indurated area can be discerned on palpation. If these symptoms occur in such diseases as ulcerative endocarditis, there is not much doubt as to the nature of the process. The pain alone will demand relief, and it is to be treated as is the pain in abscess or perisplenitis.

Amyloid disease of the spleen calls for the same general principles of management as are indicated in similar disease of the liver—namely, the removal or mitigation of the cause, the institution of

proper hygienic and dietetic regimen, and the use of tonics and of remedies to lessen congestion in the portal circulation.

The treatment of carcinoma and hydatid disease is symptomatic. Tapping may be resorted to in the latter affection, and subsequently the cyst may be opened and drained.

DISEASES OF THE THYMUS AND THYROID GLANDS, AND EXOPHTHALMIC GOITRE.

By RICHARD C. NORRIS, A.M., M.D.

DISEASES OF THE THYMUS.

From a careful study of the literature of the thymus gland it will be found that diseases of this organ are very rare. This is not surprising when it is remembered that its functional activity is confined to the first few years of life, fatty degeneration and atrophy occurring about the tenth or fourteenth year. Hypertrophy of the thymus, and the compression of the trachea resulting therefrom, have been the cause of sudden death in new-born infants. An autopsy upon a case under my observation showed the trachea to be almost completely occluded. Jacobi[1] in an extensive study of diseases of the thymus records the occurrence of hypertrophy, hæmorrhages, cysts, inflammation, tuberculosis, syphilis, diphtheria, and persistence of the gland. Malignant diseases have occasionally been found. The character of these affections is such as to baffle efforts at diagnosis, and opportunity for treatment is not likely to arise.

The gland has been removed from animals with no apparent ill effect, and in cases in which its hypertrophy will certainly produce fatal asphyxia its extirpation would seem justifiable. Syphilitic enlargement calls for inunctions of blue ointment over the gland, and the administration internally of calomel in fractional doses guarded with chalk. Cysts will require puncture and aspiration.

DISEASES OF THE THYROID.

The disease of this organ of greatest clinical importance, and the one most commonly requiring treatment, is goitre. Hyperæmia, acute inflammation, and suppuration independent of any previous enlargement, sometimes occur. Other pathological processes occasionally met with are syphilis, tuberculosis, and malignant disease, either carcinoma or sarcoma.

[1] "Contributions to the Anatomy and Pathology of the Thymus Gland," *Trans. Assoc. Amer. Phys.*, 1888.

Hyperæmia of the thyroid may be secondary to or coincident with pregnancy and menstruation, affections of the bronchi or lungs, valvular diseases of the heart, acute rheumatic or malarial fever, and arthritis. Originating in this way, the hyperæmia is usually not very great, and requires no special treatment except in rare instances: the sudden compression of the trachea and veins of the neck by an acute enlargement may demand phlebotomy or tracheotomy to prevent a rapidly fatal asphyxia. When the physiological hyperæmia and enlargement of the thyroid body in pregnancy becomes exaggerated to such a degree as to produce alarming symptoms, the advisability of inducing premature labor should be considered.

Acute idiopathic thyroiditis is certainly of rare occurrence. Should it develop as the result of injury inflicted upon the gland, it will be necessary to resort to the ordinary treatment of acute glandular inflammation, including incision and drainage in the event of suppuration.

Syphilis and tuberculosis of the thyroid are very rare. Their treatment combines active measures directed to the constitutional affection, and the same local and surgical treatment as for goitre, when suffocative symptoms indicate the necessity for such a procedure.

Carcinoma and *sarcoma* of the thyroid gland are comparatively rare. Their rapid growth and involvement of the entire gland, and the speedy generalization of the disease, render treatment by any means practically useless. Surgeons are now almost unanimous that with but few exceptions surgical interference beyond tracheotomy is not justifiable. In Kocher's[1] statistics 25 cases were subjected to surgical treatment, with a mortality of 17 per cent.

Goitre.

It will be convenient to discuss the treatment of goitre as applicable to the following varieties: fibrous, follicular, cystic, and vascular. Exophthalmic goitre, being distinctly different clinically, will receive separate consideration. The treatment of goitre may, in general, be said to comprise the use of drugs, administered internally, externally, and by injection; electricity; or one of the various surgical procedures. The choice of treatment should be determined by the size, form, situation, and variety of the tumor. When the latter by its size or by its situation, as in substernal goitre, produces pressure-symptoms, such as suffocative dyspnœa, dysphagia, or tracheal stridor, it is certain that a plan of treatment requiring for its completion days or weeks is not to be thought of, and, as will be pointed out later, one variety of goitre is often amenable to a plan of treatment which would prove utterly useless in another variety. It should also be remembered that

[1] "Bericht über weitere 250 Kropfextirpationen," *Correspondenzbl. f. Schweizer Aerzte*, Basle, 1889, xix., L 33.

the different varieties shade into one another, and in reaching a diagnosis of the variety the consistence of the enlargement will be found to vary according to the pathological processes which have been going on. In fibrous goitre the enlargement will be hard, resisting, and knotty, particularly at those portions of the gland where the overgrowth of interstitial tissue is pronounced and vascularity diminished. The follicular variety, in its early stages of development at least, will be soft and yielding. Cystic goitre is soft, and presents in certain situations distinct fluctuation, or the latter may be detected throughout the entire tumor when the follicles and their cystic contents finally intercommunicate.

Sometimes, when the contents of the gland are gelatinous, it is comparatively firm and of doughy consistence, its vascularity disappearing under the pressure of the increased distension of the follicles by their accumulating colloid contents. When the enlargement and hyperplasia of the blood-vessels, either arteries or veins, constitute the special feature of the tumor, forming the vascular variety, it will be compressible, soft, and elastic, and there may be pulsation and a distinct bruit, resembling that of aneurism.

Prophylactic Treatment.—Change of climate to a region where goitre is not endemic, and strict attention to diet and hygienic surroundings, will do much to prevent the development of this disease, and effect a cure in those already affected, particularly when the tumor is of small size. When this change of climate is impossible, the drinking-water should be investigated, and freed as far as possible from the earthy salts by boiling, by distillation, or by precipitation of these ingredients. The temporary enlargement of the thyroid during pregnancy and the menstrual flow has long been observed, and it is claimed that when there exists this tendency to the development of goitre in a pregnant woman, nursing the child had best be discarded, since it has sometimes appeared to bear a causal relation to the development of goitre. When hypertrophy of the gland exists, influences likely to check the menstrual flow should also be avoided.

Internal Treatment.—Of the various methods of treatment by medicines, constitutionally or locally, the one most commonly employed is the use of iodine or mercury in one form or another. Though occasionally successful, in the majority of cases failure to effect complete cure has more often followed their use, due unquestionably, in many instances, to the fact that the variety of the tumor has not been recognized. It is true that precise diagnosis of the variety is often difficult and sometimes impossible, as there is so frequently a combination of pathological processes, yet the preponderance of one or the other will often be sufficient to make clear the proper plan of treatment. In all varieties of goitre, iodine and its various preparations

have been largely used internally since first recommended by Dr. Coindet of Geneva, and the testimony of its curative value is strong. On the other hand, however, it has signally failed very many times, and the recorded cases of both successes and failures indicate that administered internally it is of value only in the fibrous and follicular varieties and in the early stages of the disease. The compound solution of iodine, iodide of potassium, and iodide of iron are eligible preparations, varying the dose, interchanging them, or intermitting their use as the stomach and general condition of the patient (iodism) may indicate.

Agnew[1] thus formulates the method of their administration: "If the patient is in all other respects in good health, and especially is somewhat fleshy or given to obesity, the compound solution of iodine should of preference be selected. At first the dose should be small, in order to test the tolerance of the stomach, not exceeding 5 or 6 drops three times a day, taken in some sweetened water, orange syrup, or curaçoa, and always about one hour after meals. Every two or three days the dose may be increased one or two drops until 18 or 20 are taken, beyond which it is not desirable to go." Should iodism occur, or after two or three months' continuous treatment should no impression be made on the disease, he advises the substitution of the iodide of potassium, 5 to 20 grains three times a day, dissolved in water and syrup and well diluted. When anæmia is associated with the disease, iodide of iron and cod-liver oil may be alternated with the remedies already directed.

Local Treatment.—In conjunction with the constitutional treatment just described in these varieties of goitre, considerable improvement can be expected from local applications, either in the form of ointments or by hypodermic injections. For the former, iodoform and the iodide or red oxide of mercury will be found useful. Iodoform may be prescribed in the strength of 1½ drachms to 1 ounce of lanolin, petrolatum, or benzoated lard, to be rubbed into the gland morning and evening, preferably before an open fire, and lint spread with the ointment should be kept in contact with the swelling. Should the preparations of mercury be selected, the following formulæ will be found of service:

℞. Ung. hydrarg. iodid. rub.,
Petrolati, āā. ℥ss.—M.

A portion of this ointment about the size of a walnut should be rubbed in daily or every other day, according to the degree of irritation produced:

[1] Pepper's *System of Medicine*, vol. iii. p. 981, Phila., 1885.

℞. Pulv. hydrarg. oxid. rub., ʒij;
Lanolini, ʒj.—M.

Brown[1] recommends this ointment very highly, claiming that it rarely irritates the skin except in warm weather, when its strength should be reduced. He insists upon having the drug in very fine powder before its incorporation into the lanolin, and advises the strength to be increased to saturation, as it is found to be well borne. Frequently the efficacy of an ointment can be increased by the application of pressure to the gland, but should the skin begin to resent it by giving evidence of irritation, it should be discontinued.

In a large proportion of cases this local treatment will accomplish little more than slight reduction in the size of the tumor, and injections may at this time, or even earlier, be resorted to with more hope of success; yet this procedure will also frequently be more or less of a failure in effecting complete cure. It is more apt to be serviceable in follicular and cystic than in fibrous enlargement. The drugs employed for this purpose are numerous. Iodine, ergotin, iodoform, alcohol, osmic acid, perchloride of iron, and solutions of arsenic, have all been used with asserted success, iodine occupying the foremost rank in follicular and fibrous goitre since first recommended by Lück in 1867. The syringe and the skin over the point of puncture should be antiseptically clean, and, the needle being thrust in half an inch to an inch, from 8 to 30 drops of the tincture are slowly injected, after which the opening is to be closed by adhesive plaster or similar dressing. The injections should usually be made twice a week, and the quantity used is that given above, but the frequency and amount are determined for each individual case by the degree of reaction. After one or two injections, a different point of entrance being selected each time, a syringeful has been used without causing complications. A single injection in cases of small tumors has been sufficient. Following the operation, pain, varying in severity, is usually to be expected in the teeth, ear, eye, and maxillary articulation on the side on which the injection has been made; and if the latter is low down some discomfort in the chest may be present. Elevation of temperature and signs of aggressive inflammation contraindicate a repetition of the injection until they have completely subsided.

Ergotin by injection has given good results. It has been used with success by Pepper, DaCosta, and others. The solution employed is made by dissolving 96 grains of ergotin in 1 ounce of distilled water, of which 6 to 10 minims are injected weekly. The fluid extract of ergot may be similarly used, the dose being from 10 to 20 drops. Mosetig v. Moorhof claims that iodoform has the advan-

[1] *North American Practitioner*, Aug., 1890.

tage over other drugs for hypodermic injection that inflammatory complications never occur. He recommends the following solutions: Iodoform 1 part, ether 5 parts, olive oil 9 parts; or iodoform 1, ether and olive oil, each 7 parts. He injected from 15 to 30 drops of this mixture five to ten times, at intervals of three or four days, in 79 cases, and invariably noticed a decrease in the size of the neck of from one to two inches. In no instance did suppuration occur.

While the treatment of goitre by parenchymatous injection is often measurably successful, it is attended by many complications, such as haemorrhage or embolism, violent inflammation, suppuration, and septic poisoning, and is, therefore, by no means devoid of danger. Death has occurred in several reported cases after many weeks of prolonged suppuration, or more speedily from obstruction to respiration occasioned by rapid swelling of the gland. Doubtless there are many unrecorded cases of this unfortunate result. Its relative value as a method of treating the varieties of goitre to which it is applicable is certainly less since the results of the recent surgery of the thyroid body have been made known.

Although constitutional treatment, of the character outlined when discussing fibrous and follicular goitre, has been resorted to very frequently in the treatment of cystic bronchocele, it has invariably been a signal failure. The only possible benefit to be derived from drugs is by their local application in the form of injection. When the cysts are multiple and thick-walled, the process is tedious, repeated injections being required, or, as recommended by Agnew, it may be necessary to break up the separating walls of the cyst by a plunger, so as to favor the diffusion of the drug used. In a single cyst with thin walls puncture followed by injection is usually curative. The perchloride of iron is preferable to iodine, being less dangerous, and the method to be employed is that of Morell Mackenzie. The cyst is tapped at its most dependent part with a trochar, the cannula of which corresponds in size to a No. 8 or 9 English catheter. After the contents partially escape, 1 to 2 drachms of a solution of perchloride of iron (2 drachms to distilled water 1 ounce) is injected, and allowed to remain for three days, the cannula having been corked and kept in position by a tape passed around the neck. At the end of this time the plug is removed, and if suppuration has not occurred the injection is repeated. When suppuration occurs the plug is removed, and the cavity is treated as a chronic abscess by washing with antiseptic solutions and applying poultices to the neck. In 193 cases so treated there were 2 deaths, the goitres in the fatal cases being partly fibrous.

In the vascular variety of goitre, or when the goitre is rich in its blood-supply, ergot administered internally in 10- to 30-drop doses of the fluid extract will be useful. Iodine is practically worthless.

Locally, 10 to 30 drops of the fluid extract of ergot may be injected, or ergotin may be used as has been directed for the fibrous and follicular varieties. Deep injections, at intervals of four or five days, of 4 or 5 drops of carbolic acid, liquefied by the smallest possible quantity of glycerin, are also worthy of trial.

Electrical Treatment of Goitre.—The successful treatment of goitre by electricity is confined to the use of electrolysis by galvanopuncture, and possibly the employment of the galvanic current in conjunction with drugs to secure a cataphoric action.

That electrolysis is curative in some varieties of goitre is unquestionable, and it is equally true that it sometimes utterly fails. It will be most useful when employed for goitres of comparatively small size —*i. e.* in the early stage of their development, when they are soft and of the follicular variety, as is so often the case. Purely fibrous goitres are also frequently benefited, if not cured. Even the vascular variety has improved, under its action, although it usually fails, as it does in cystic goitre, and in both it may prove harmful. Successful treatment of goitre by this means has been frequently reported, notably by Amory, Baird, Campbell, Chvostek, Duncan, Gröh, Ingalls, Lloyd, and others. Duncan[1] completely cured 6 of 14 cases, the others being more or less benefited. Ingalls reports[2] success with electrolysis after failure with aspiration and injection of carbolic acid. Lloyd cured 2 favorable cases.

In the application of electrolysis the following points should be borne in mind:[3] The negative needle or needles, properly cleaned and well insulated to protect the skin, should be introduced into the tumor about one-third of an inch, care being taken to avoid blood-vessels. The positive pole is applied to the nape of the neck by means of a large flat sponge electrode. The strength of the current should be as great as the patient can bear, the average being from 14 to 20 milliampères, which should always be measured accurately by a milliampèremeter, and a water rheostat should be used to avoid shocks. The length of each sitting should be about twenty minutes, and the application repeated at intervals of about two weeks. Inflammation in the gland will sometimes follow, although it is usually mild and transient, suppuration being of very rare occurrence. Permanent results sometimes are not manifest until the treatment has been persisted in for some time, and once begun the decrease in the swelling progresses after the applications have been discontinued. As the gland is not completely destroyed, the possibility of the development of myxœdema is reduced to a minimum.

At a meeting of the Richmond Academy of Medicine and Surgery,

[1] *British Med. Journ.*, Nov. 3, 1888.
[2] *Journ. Am. Med. Assoc.*, xiv., 1890.
[3] See paper by Dr. James Hendrie Lloyd, *Trans. Coll. Physicians*, Phila., 1890.

July 6, 1891,[1] Hunter McGuire described the cataphoric treatment of goitre by means of a cup-shaped electrode, in which is placed some absorbent cotton first dipped in water and squeezed as dry as possible; and on this cotton 10 or 15 drops of the tincture of iodine is poured. The electrode, thus prepared, is placed on the most prominent part of the goitre, the negative pole on the back of the neck. A galvanic current of 6 or 8 milliampères is passed daily for ten minutes over a period of several weeks. Three cases of chronic goitre treated in this way gave the same result: the hypertrophy diminished, rapidly at first, then more slowly, and finally became stationary. In 4 cases of recent hypertrophy of the thyroid in young women the enlargement rapidly disappeared. What proportion of the good results from this plan of treatment is due to one or the other of these agents it is impossible to say. The varieties of goitre most likely to be benefited are those which are more or less amenable to the injection of iodine and the employment of electrolysis—namely, the follicular, fibrous, and possibly the vascular varieties.

Surgical Treatment.—While a discussion of the surgical treatment of goitre is not altogether in place in a volume of the character of this work, it may not be amiss, in a general way, to outline the resources of surgical intervention and its results, in view of the fact that in recent years the most noteworthy advance in the treatment of goitre is certainly the resort to surgical procedures. Among those who have done most to advance the surgery of the thyroid gland are Kocher, Keser, Billroth, Socin, Nichaus, Mikuliez, Trzebicky, Porta, Jullliard, Müller, Garrè, and Berry. To the work and literary contributions of the last the writer acknowledges especial indebtedness for many facts.

When, in spite of thorough medical and electrical treatment, hypertrophy of the thyroid gland continues until the life of the patient is threatened by the appearance of pressure-symptoms—an event which fortunately is rare—or when, before this occurs, application is made to surgical art for relief, the procedures to be considered are the introduction of a seton, incision and drainage, ligature of the thyroid arteries, division of the isthmus or middle lobe, extirpation of a portion of the gland, and enucleation.

Introduction of a Seton.—This is an antiquated method of treatment and is no longer employed. Its great dangers of hæmorrhage and long-continued suppuration have finally made it obsolete, and it is only mentioned to be condemned.

Incision and Drainage.—For cases wholly or in large part cystic, when enucleation is for any reason contraindicated—this operation may be performed. The cyst should be exposed by a careful dissection and

[1] Quoted in *Cincinnati Lancet Clinic*, Aug. 15, 1891, from *Virg. Med. Monthly.*

incised, the cyst-wall stitched to the skin, and the cavity irrigated with an antiseptic solution. A drainage-tube and iodoform gauze packing are introduced into the cavity and an antiseptic dressing applied. Dr. John B. Deaver[1] believes that this operation offers the best treatment for such cases when thyroidectomy is contraindicated.

Ligature of the Thyroid Arteries.—This method of treatment, first suggested by Wölfler of Gratz, aims to cause atrophy and gradual disappearance of the tumor by ligature of the nutrient arteries. The difficult character of the operation, the danger of injuring the sympathetic nerve, and the usual establishment of an extensive collateral circulation, have made it a question to most surgeons whether much is to be gained by this method of treatment. It is not suitable for cystic and fibrous goitres, and should be reserved for cases of early follicular or vascular tumors. It can, perhaps, be done with advantage in conjunction with division of the isthmus when for any special reason the latter is employed. In 7 cases of ligature of the afferent arteries in Billroth's clinic,[2] in 3 enucleation had to be performed within three years; 4 were permanently cured. Rydygier[3] reports 16 cases, in 1 of which there was only slight diminution in the size of the tumor; in another one lobe contained a cyst which subsequently required enucleation. Whether the arteries on both sides or on one side only, or the lower blood-vessels alone, or the afferent vessels of the large portion of the goitre, are ligated, as have severally been recommended, the operation is now generally thought to be of very restricted usefulness.

Division of the Isthmus or Middle Lobe.—When the tumor is very large, involving the entire gland, division of the isthmus will frequently relieve the dyspnœa mechanically, the two halves of the tumor being thus separated. Mr. Berry[4] believes that it more often relieves the respiratory difficulty by draining the gland of its colloid secretion, and that while the relief afforded may be permanent, the goitre frequently returns when the wound has healed, and the secretion is again pent up in the gland. It should be remembered also that urgent dyspnœa has sometimes not been relieved sufficiently quickly, and in some cases tracheotomy or removal of a large portion of the gland has been necessary.

Extirpation of a Portion of the Gland.—The immediate danger of injury to the recurrent laryngeal nerve and the remote danger of myxœdema or tetany have rendered the operation of complete removal of the thyroid body generally unjustifiable. Partial extirpation, however, has been attended with such success as to give it a definite

[1] *American Lancet*, July, 1891. [2] *Brit. Med. Journ.*, May 31, 1890.

[3] *Wien. med. Wochensch.*, 1888, xxxviii., 1683; *Centralb. f. Chir.*, Leipzig, 1889, xvi. 241.

[4] *British Med. Journ.*, June 20, 1891.

and meritorious position in the surgery of the thyroid. It includes the removal of one lobe; resection of the chief part of one or both lateral lobes, avoiding the recurrent laryngeal nerves by leaving behind in relation to them sufficient gland-tissue to carry on the functions of the gland; and resection of the intervening portion of the isthmus between two ligatures. When the goitre is unilateral, the removal of the enlarged lobe is indicated. When there is diffuse hypertrophy or numerous small nodules with no normal gland-tissue, resection is to be performed. Resection of the isthmus is rarely indicated, as it does not usually remove enough tissue to relieve the dyspnœa permanently, and is not devoid of danger.

Enucleation.—This operation is applicable to cystic and fibroid tumors which are surrounded by a capsule and more or less healthy gland-tissue, thus permitting the removal of the solid or cystic tumor from the interior of the gland, the surrounding glandular tissue being left intact. Keser[1] and Kocher,[2] who have contributed largely to our knowledge of the value of this operation, discuss its advantages and limitations. Keser states that the operation can be done rapidly, usually without great hæmorrhage; that the recurrent laryngeal nerves are never injured; and that cachexia strumipriva or tetany is never a sequel. When the gland is the seat of diffuse hypertrophy or disseminated nodules or malignant disease, he considers enucleation contraindicated. Kocher favors the operation in many cases, and his greatest objection to it is that recurrence is more apt to occur than after partial extirpation. He considers enucleation applicable to single large cysts or large solid tumors loosely imbedded in healthy gland-tissue. Of the recorded cases of enucleation in the hands of the best operators, I find the death-rate somewhat less than 1 per cent.

Cachexia Strumipriva.

As to the occurrence of cachexia strumipriva as a remote result of thyroidectomy, I cannot do better than quote the conclusions of Berry,[3] based upon an extensive statistical study. If the gland be completely removed, there is very great risk that this sequel will supervene, although it is not absolutely certain that it will do so in all cases. The risk, however, is sufficiently great to warrant us in laying down the rule that complete extirpation of a goitrous thyroid gland should never be performed. It has unfortunately followed partial extirpation in a few cases, but the cases in which this has happened are exceedingly few in number, and in them the symptoms of the disease have

[1] *L'Enucleation ou Extirpation intraglandulaire du Goitre parenchymateux*, Paris, 1887.

[2] "Bericht über weitere 250 Kropfextirpationen," *Correspondenzbl. f. Schw. Aerzte*, Basle, 1889, xix. L. 33.

[3] *Brit. Med. Journ.*, June 27, 1891.

usually been slight and temporary. The treatment of this sequel is unfortunately very unsatisfactory. The patient should be kept warm, and, if possible, sent to a warm climate. Pilocarpine, jaborandi, and nitro-glycerin have been recommended, as in myxœdema. The transplantation of thyroid tissue into the abdominal cavity of the patient has been suggested and practised, and Mr. Horsely[1] believes that the beneficial results of the operation have been established. It has, however, been done but seldom, and then with only temporary improvement, so that future experiments must decide the true value of the procedure.

EXOPHTHALMIC GOITRE (GRAVES' DISEASE; BASEDOW'S DISEASE).

THE plans of treatment advocated and the numerous drugs which have from time to time been reported as successful in the treatment of this mysterious disease simply emphasize our ignorance of its precise etiology and pathology, and therefore render the treatment in greatest measure symptomatic. The theory of nervous origin is most generally believed in, and the lesion thought to be most probably in the medulla and upper cervical portion of the cord—a conclusion which seems warranted by the involvement so frequently in this disease of other centres known to be situated there—namely, the cardio-inhibitory, accelerator, vaso-motor, vomiting, and glycogenic centres. In the absence, therefore, of accurate knowledge as to etiology and pathology upon which to lay the foundations of an exact and rational therapy, it will be convenient to direct our treatment to the important symptoms and complications which arise in this disease. It should be remembered that there is no specific or special mode of treatment applicable to all cases.

The principal element in the successful management of exophthalmic goitre is the removal of the patient from the environment in which the disease has had its origin to surroundings agreeable and most likely to secure rest of mind and body. Occasional mental diversion is desirable, particularly when despondency is pronounced. When possible, an inland region of not very great altitude should be selected. The well-known ill effect of the atmosphere of elevated situations upon an exhausted and irritable nervous system indicates very clearly that a mountainous district of great altitude is not to be selected as the abode for sufferers from this disease. Curtin,[2] who has made a careful clinical study of the disease, and has observed a large number of cases over a period of years, concludes that a mountain residence is unfavorable for developed cases, and even for persons who have only a hereditary tendency in this

[1] *Brit. Med. Journ.*, 1890, ii. 201. [2] *Trans. Amer. Climat. Soc.*, Sept., 1888.

direction. Dampness and exposure to cold should be scrupulously avoided, as so many cases give evidence of past or present affections of the respiratory tract, such as chronic rhinitis, pharyngitis, or bronchitis; and when these exist appropriate treatment will be followed by marked improvement in the general condition.[1]

Patients suffering from this disease frequently do badly by the sea, yet when sea-bathing is known to be agreeable, and not too invigorating, to the patient, it can be moderately indulged in with strikingly good effect. Considerable success has been attained in many cases by hydropathic treatment, as recommended by the French physicians. The hygienic surroundings should be most carefully attended to—regular rest, exercise with salt sponge-baths, and frictions. The diet should be such as to improve the general nutrition, and tobacco and alcoholic and malt liquors must be discarded. This complete change in the patient's surroundings, and careful attention to the details of his daily life, are absolutely essential to the success of any special form of treatment.

Milk in generous quantity, cod-liver oil, arsenic, quinine, iron, and other tonics are to be employed when specially indicated. Coexisting disorders of any nature should be corrected. This is particularly true of anæmia, which is rarely absent, and when present to a marked degree is productive of the mental depression, hysterical manifestations, neuralgic pains, vertigo, etc. which are so frequently noted in this disease. Preparations of iron should be administered continuously over a long period of time. Flint[2] records a case in which recovery took place, the patient having taken 2 grains of reduced iron thrice daily for three years. As the greater proportion of cases of Graves' disease is found in women between puberty and middle age, and since uterine disorders so frequently coexist, the latter should always be looked for and if present appropriately treated.

Digestive derangements are very prone to occur, and should always receive first attention, as without their correction other treatment will avail but little. A diet restricted to milk, broths, farinaceous foodstuffs, etc. may be required.

Rest in bed is advisable when the patient is very weak or nervous, and troublesome insomnia requires narcotics. It is best to avoid opium as far as possible, the bromides being chosen in their place, but it may be necessary to employ the former.

The cardinal symptoms of exophthalmic goitre are cardiac palpitation and pulsations in the larger blood-vessels, goitre, exophthalmos, and vibratory tremor. It is to the amelioration of these that treatment will be directed. The patient should be told that the disease is not

[1] Fiske-Bryson, *N. Y. Med. Journ.*, Dec., 1889.
[2] Pepper's *System of Medicine*, vol. iii. p. 766.

directly dangerous to life; that, while it tends to long continuance, it not infrequently improves to a very marked degree; and that sometimes it disappears altogether.

Treatment directed to the Heart and Circulation.—Of the cardinal symptoms of Graves' disease, cardiac palpitation and pulsation in the larger blood-vessels are the most constant, and usually the first to develop. They are also the symptoms which usually cause most discomfort to the patient, disturbing as they do other functions of the body, and for which relief is sought. When the disease is of long standing, inducing dilatation, or when from other causes there exist organic changes in the heart, treatment should be directed to these changes, as under other circumstances. The rapid and tumultuous heart-action is a rational indication for the employment of drugs known to lessen the frequency and force of the cardiac pulsations. For the former purpose digitalis or strophanthus is to be used. All writers agree that digitalis is a useful remedy in this disease. Recently the reports of the use of strophanthus are numerous and satisfactory[1] in improving the pulse-rate and rhythm of the cardiac contractions in exophthalmic goitre. Unlike digitalis, it does not much contract the calibre of the arterioles, and thus increase the work of the heart, yet, like digitalis, it markedly lengthens the intervals between the contractions. In a case under my observation it afforded great relief after digitalis had been faithfully tried with only slight benefit. The tincture should be given three times daily after meals, the initial dose being from 8 to 10 drops, which may be increased, if necessary to reduce the frequency of the pulse, to even 25 drops.

In some cases the sedative action of aconite, veratrum, or gelsemium may be resorted to with more benefit than either digitalis or strophanthus. Flint speaks highly of aconite, and says[2] it has proved more satisfactory than digitalis in his experience. When the muscular action of the heart is vigorous and powerful, particularly when associated with hypertrophy, which is not infrequent, their depressant action would seem desirable. Under such circumstances veratrum viride will be found of service, 1 drop of the fluid extract given every three hours, and increased or diminished according to the effect upon the pulse and cardiac contractions. Belladonna and its alkaloid, atropine, have been largely used, and in some cases have been more beneficial than the drugs just mentioned. Ramsay,[3] who has studied this disease exhaustively, concludes that of all drug treatment probably that from which the best results are most frequently obtained is the use of belladonna or atropine, and that ergot, the bromides, and the iodides, in spite

[1] *N. Y. Med. Journ.*, Aug. 4, 1888, and Nov. 8, 1890; *Journ. Am. Med. Assoc.*, Sept. 1, 1888, and Nov. 3, 1888.

[2] *Loc. cit.*

[3] *Glasgow Med. Journ.*, Aug., and Sept., 1891.

of all that has been written in their favor, rarely fail to give disappointing results.

Since first recommended by Benedikt[1] in 1865, electricity has been used with undoubted success. Many chronic cases have been benefited by its use after drugs have proven an absolute failure. It is said to cause undue excitement in acute forms of the disease.[2] Nothnagel[3] considers persistent electrical treatment, combined with a hydrotherapeutic course, the most efficient treatment of the disease. Galvanism is superior to faradism for this purpose. A current of 2 to 3 milliampères is sufficient,[4] the applications being made three times a day, each lasting six minutes. The anode should be placed on the nape of the neck, the centre of its lower border corresponding to the seventh cervical spinous process. The cathode should be moved up and down the side of the neck from the mastoid process along the course of the great nerves. Bartholow[5] gives the following directions: "An electrode—the anode—is placed in the angle behind the jaw, and the cathode on the epigastrium, and a stabile current is allowed to flow for three to five minutes. The cervical spine should also be galvanized. It may be included in a circuit by placing the anode over the vertebræ in turn, whilst the cathode rests on the epigastrium. Stabile may be varied by labile applications." After application of the current by either of the above plans, the frequency and force of the heart-beat are reduced temporarily, prolongation of the diastole being most marked; and as the treatment is continued these effects become permanent. Charcot advises the application of the faradic current to the eyelids, the goitre, and the cardiac region, in addition to the current applied to the neck. In a case of pronounced exophthalmic goitre Hunter McGuire[6] obtained by cataphoric treatment with iodine rapid diminution of the enlarged thyroid gland, and a decided amelioration of the other symptoms.

Although the majority of cases of Graves' disease continue for several years, and are rarely directly dangerous to life, not infrequently the attacks of palpitation are of such violent character as to jeopardize life and call for prompt and active treatment. When the patient's general condition will permit it, venesection may be resorted to, but usually the attack will be more safely combated by an ice-bag to the præcordial region or over the neck, as recommended by Nothnagel; the free use of cardiac stimulants, as ether, Hoffman's anodyne, digitalis, strophanthus, nitrite of amyl by inhalation, and morphine and atropine hypodermically. The violence of the heart's

[1] *Aerzt. Zeitschr. f. Prakt. Heilk.*, 1865.
[2] Cheadle, *Brit. Med. Journ.*, Jan., 1890.
[3] *Practitioner*, March, 1890.
[4] Cardew, *Lancet*, 1891, No. 3540.
[5] *Medical Electricity*, Phila., 1881.
[6] *Loc. cit.*

action can also be greatly diminished by the application of a sufficiently strong galvanic current to the pneumogastric nerve.

Treatment directed to the Enlarged Thyroid.—Usually the enlargement of the thyroid gland requires no special treatment. The measures recommended above will in most cases cause a diminution in the size of, and lessen the pulsations in, the gland, *pari passu* with the improvement in the cardiac symptoms. In addition to these, however, a weak continuous current applied to the gland with a large plate electrode may be resorted to. Lister's cold coil has benefited some cases, and DaCosta[1] has recommended the daily application of ice. Recently, MacNulty[2] has employed a Martin's bandage around the throat, to be worn during the day and taken off during the night.

Belladonna collodion has been found of service for the violent pulsations in the gland. Iodine, so commonly used in ordinary bronchocele, should not be employed in exophthalmic goitre. Practically, the same may be said of ergot, although it has sometimes been of apparent service, administered both internally and by hypodermic injection, the dose and method being the same as described for ordinary bronchocele. Sulphuric acid has apparently been of service in some cases.[3] Without further mention of the various drugs extolled from time to time, it may be remarked that the tranquillizing effect of a placebo has often been followed by marked improvement, and no doubt the beneficial results claimed for various drugs can in great measure be thus explained. Tracheal obstruction by pressure of the enlarged gland is very rare in exophthalmic goitre. Its occurrence should be promptly met by the inhalation of chloroform, followed if necessary by tracheotomy, incision of the capsule of the tumor, or division of the isthmus, and even partial extirpation.

Treatment directed to the Exophthalmos.—Whether the protrusion of the eyeball be due to turgescence of the blood-vessels of the orbit and an increase or swelling of the orbital fat, or to contraction of a layer of unstriped muscular fibre crossing the spheno-maxillary fissure described by Müller, there is as yet no means of directly lessening to a great extent this distressingly prominent symptom. This is particularly unfortunate, since the prominence of the eyeball is so frequently a source of mortification to the patient, contributing to despondency by its being an ever-present deformity. A compress and bandage worn during sleep have been of service, and in conjunction with this a mild faradic current may be used daily. As a matter of experience DaCosta[4] has found it very suitable to give an occasional saline purge. It is always followed by better vision, and is all the more

[1] *College and Clinical Record*, Oct. 15, 1880.

[2] *Rev. international de Bibl. médicale*, No. 2, 1891.

[3] *Med. News*, Nov. 3, 1888.

[4] *Loc. cit.*

indicated when cerebral symptoms exist. By far the most important treatment directed to the eyes is the prevention of an irritative conjunctivitis and consequent corneal ulceration, which not infrequently occurs as the result of the insufficient covering and excessive dryness of the protruding eyeballs. As far as possible, reading, writing, or other efforts in any way productive of eye-strain should be avoided. If necessary, a simple emollient, as lanolin or vaseline, should be applied to the lids and the eyes covered with a bandage. The smarting and burning can often be relieved by cold compresses. At the first sign of inflammation careful treatment should be instituted to prevent ulceration, and in the event of the latter occurring confinement to bed will be necessary to follow out accurate antiseptic management. When the exophthalmos is so great as to threaten grave inflammatory changes in the eyeball, tarsorrhaphy, as recommended by Von Graefe, becomes a desirable operation to close the lids partially and lessen the deformity.

DISEASES OF THE MOUTH AND SALIVARY GLANDS, INCLUDING MUMPS.

By A. D. BLACKADER, M. D.

At the outset of any remarks on the treatment of diseases of the mouth it seems advisable to make some reference to the connection that by many authors is considered to exist between ailments in the mouth and pathological conditions in the lower portions of the alimentary canal—an opinion that has, possibly, arisen from the furred condition the tongue assumes in many affections of the stomach, and from the occasional appearance of aphthous spots with coincident dyspepsia. That the eructation or vomiting of acrid and fermenting matter may produce some irritation of the oral mucous membrane, and that prolonged retention of fæcal matter in the bowels may injuriously affect the secretions of the mouth, will probably be admitted by most. "But it is a mistake," quoting the words of a recent writer,[1] "to ascribe, as is so commonly done, the greater number of inflammatory conditions of the mouth to an existing gastro-enteric perversion. And although bad feeding and improper hygienic surroundings are responsible for many affections of the mouth, as well as of the stomach and intestines, it is not by any previous dyspepsia that the former are caused, but rather they are as much primary in origin as are the latter." In many cases the sequence appears to be the other way, for the swallowing of large quantities of saliva and mucus teeming with pathogenic micro-organisms must interfere seriously with the action of the gastric juice. Distinct recognition in the matter of treatment must therefore be accorded to affections of the mouth, apart from any coincident troubles of the stomach. In at least all the more severe inflammatory affections of the mouth local applications are demanded, and to these, if suitable, the ailments quickly yield; but treatment directed only to the stomach cannot be considered as filling the more important indications.

In securing this local action drugs may be used either as mouth-washes or sprays, or may be applied directly to the part by means of a camel's-hair brush. Mouth-washes for infants may be used either with

[1] W. W. Allchin, M. D., art. "Diseases of the Mouth," in Keating's *Cyclopædia of the Dis. of Children*, vol. iv.

a swab of absorbent cotton on the end of a small piece of wood suitable as a handle, or may sometimes be thrown into the cavity of the mouth with a syringe, the head being sufficiently inclined forward to allow the escape of the fluid from the mouth. In the case of adults mouth-washes are kept in contact with the walls of the oral cavity for the longest possible time by slightly dilating the cheeks. In ordering the wash not only must the ingredients be carefully selected, but the strength of the solution must be adjusted to each case.

With a few drugs not only do we secure a local action by their use in these ways, but also a secondary action by the elimination of the drug through the salivary glands. Notably is this the case with potassium chlorate, which, when taken internally, appears in the saliva in five or ten minutes, and continues to be secreted for some hours. In this way we obtain a secondary topical effect, much to be desired because less irritating and more continuous. It should be always borne in mind, however, that in large doses it affects the secretion of urine unfavorably. The quantity administered during the whole period of the twenty-four hours to an adult should never exceed 1 drachm or 1½ drachms, and to a child of three years 20 or 30 grains. It is best given in small doses, repeated every two or three hours, and should be always largely diluted to lessen its irritating action on distant organs. Whenever it is administered in full amounts, Forchheimer[1] recommends that the physician should always impress on the attendant the necessity of watching, lest any diminution or cessation occur in the secretion of urine. Coincidently, a state of drowsiness is occasionally noted. Both are to be regarded as important danger-signals. On their appearance the exhibition of the drug must be at least temporarily discontinued.

In making local applications to the mouth it is very necessary that gentleness should be used. "Roughness should be avoided in treating sore mouths; not to mention the pain that is given, we do absolute harm by using mechanical violence. In but one form of stomatitis is it necessary to remove anything. In all the rest applications made by the gentlest means will give the best results." Especially is this the case if we are dealing with infectious processes, where any undue irritation of the mucous membrane renders an extension of the disease more liable.

Absolute cleanliness of the mouth at all times is demanded as a simple matter of hygiene. Much more is it necessary when through disease the secretions of the mouth are altered, or when through debility or pain the muscles of the tongue and mouth are prevented from using their wonted activity. In all inflammatory states of the system it is desirable to direct the attendant to have the patient's mouth

[1] *Archives of Pediatrics*, Sept., 1888.

washed thoroughly at least twice a day, better still, after each time of feeding, with some slightly alkaline and antiseptic wash. A solution of bicarbonate of sodium (5 grains to 1 ounce), with 2 or 3 drops of carbolic acid or 15 or 20 of listerine, makes a suitable mouth-wash; or 10 or 15 drops of Condy's fluid in a half tumbler of water, or one of Seiler's antiseptic and alkaline tablets, dissolved in 2 ounces of water, can also be conveniently used.

In infants gentle washing of the mouth with a small pledget of absorbent cotton on the end of a holder should take place after each time of feeding. Either simple (cool or tepid) water may be used, or, should the circumstances demand it, it may be rendered slightly alkaline or distinctly antiseptic.

Catarrhal Stomatitis.

Catarrhal stomatitis is the simplest of the inflammatory forms of sore mouth, and generally yields readily on the removal of the cause of irritation. In young infants we very often find more or less injection and painful swelling of the gum shortly before the tooth pierces it. This local form is best relieved by the frequent application of simple cool water to the gum, to which, if thought desirable, may be added a few grains of boric acid. Any additional irritation, however, at this time will probably cause a considerable extension of the inflammation. Lack of cleanliness in the mouth, in the feeding-apparatus, or in the food is one of the more common sources of trouble. Frequently the materials given to an infant to suck or bite on when teething are either of a fermentable character or are not kept in a cleanly condition. Epstein ascribes the frequency of this ailment in infants to the irritation of the air, especially when they are allowed to breathe through the mouth; to the mechanical act of sucking when there is any difficulty, either owing to the scarcity of milk in the breast or to nipples imperfectly developed; or to the natural tenderness of the epithelium in early infancy, and the often too energetic cleansing of the oral cavity on the part of midwives or others in charge of the child. Many authors regard the occurrence of the disease as an indication of impaired nutrition in the infant. There can be no question that in a weakened state of the system the mucous membrane reacts more quickly and to slighter causes of irritation than if the infant's health be more vigorous. Ascertaining the cause of trouble and removing it generally lead to a prompt subsidence of the trouble, especially if cleanliness of the oral cavity be maintained by gentle washing with a cool, soothing application, such as boric acid, in the proportion of 5 to 10 grains to the ounce; borax, 5 to 20 grains to the ounce; bicarbonate of sodium, 10 grains to the ounce; or, finally, chlorate of potassium, 5 to 10 grains to the ounce.

Should the inflammation appear more severe or be persistent, more astringent lotions will be indicated, of which perhaps the best is a solution of silver nitrate (from 2 to 5 grains to the ounce). The inflamed surface, after careful cleansing, ought to be gently pencilled with this solution once a day. Should any distinct spots of ulceration appear, they may be lightly touched with a silver probe armed with a small quantity of the mitigated stick of silver nitrate. By many physicians the administration of potassium chlorate is advocated in this affection. My own opinion agrees with that of Dr. Forchheimer,[1] that it is of little service and unnecessary, and therefore, on account of the risk attendant on its administration at a very early age, it should not be used. Occasionally, in young infants, this ailment is accompanied by pyrexia, and is associated with much restlessness and fretfulness on the part of the infant. To relieve the pyrexia small doses of aconite, potassium citrate, or any suitable fever mixture may be administered, to which bromide of potassium may be added if there is much restlessness. If this should fail, the careful administration of an opiate to relieve pain may be allowed. Dr. J. Lewis Smith recommends the application of a little borax, either with honey or with glycerin and water. A solution of alum (5 to 10 grains to the ounce) and a solution of tannin and glycerin (glycerite of tannin 2 drachms, water 1 ounce) have also been recommended, and may, if desired, be tried. Cysts in the mucous membrane, if they form, must be opened by free incision, and if necessary cauterization of their walls may be resorted to. If the general nutrition is imperfect, the infant's diet must be carefully regulated; the stomach and bowels must be gently stimulated for the more effective performance of their functions, and later on some bland ferruginous tonic should be administered, such as—

℞. Ferri et ammonii citrat., ℥ss;
Pepsinæ glycerit., ℥iij;
Elixir. simp., ℥iv;
Aquæ, q. s. ad ℥j.—M.
Sig. A tea-spoonful three times daily, after meals.

In cases occurring near adult age the same general rules apply, although we shall find the sources of irritation to be of a different character. Sharp teeth, dental caries, ingesta too hot or too cold or too acid or too highly seasoned, the immoderate use of alcohol or tobacco, and the swallowing of any irritant, may all give rise to an attack of stomatitis. In these cases a simple bland diet must be ordered, which should be taken lukewarm or decidedly cool, as may be found most grateful

[1] *Arch. Pediatrics*, Nov., 1888.

by the patient. Should the stomach be irritated or the bowels constipated, a saline laxative may be ordered, followed by some simple alkaline bitter as a stomachic. The use of alcohol and tobacco must be interdicted: offending teeth are to be repaired or removed at once; at the same time some simple mouth-wash is to be used frequently during the day. Any of the solutions directed above will be suitable. Should pain be a prominent symptom, the mouth-washes may be made more emollient by using either gum-water, barley-water, or quinceseed-water instead of simple water in preparing them; a small quantity of an opiate may be added if necessary. Sometimes the gum behind the upper incisor is particularly complained of, and on examination it will be seen to be much swollen and extremely sensitive. Much relief will be obtained in these cases by gently pencilling it with a solution of silver nitrate (10 to 20 grains to the ounce), or with glycerin of tannin, or with tincture of rhatany.

Catarrhal stomatitis accompanies most of the exanthemata and continued fevers. Absolute cleanliness of the mouth, along with some slightly alkaline wash, fulfils all the indications, which in these cases must be quite secondary to the more important disease.

Aphthous Stomatitis.

In aphthous stomatitis we have a painful and very troublesome affection, of the exact pathology of which we are still uncertain. It is a more or less self-limited disease, with symptoms almost entirely local. Rarely, and only in children, have we any constitutional disturbance. In children, in the confluent form of the disease, we may have pyrexia with associated gastric or intestinal derangement, the mouth becomes hot and dry, and sucking or mastication is painful. In the treatment of this all sources of irritation must be forbidden; as mastication is painful, only soft food should be allowed. Demulcent mouth-washes may be ordered, such as mucilage of gum arabic, of slippery elm, of marshmallow, or of flaxseed, rendered slightly alkaline with sodium bicarbonate (5 grains to the ounce). If the pain is very severe, opium in small quantities may be added. After a few days the spots may be touched lightly with silver nitrate in stick or in solution (20 to 30 grains to the ounce), or if the ulcers are very numerous the surface may be brushed over lightly with a weaker solution (10 grains to the ounce). Baginsky[1] strongly recommends a solution of potassium permanganate as a mouth-wash. It may be given a fair trial, although I have not been able to convince myself of its special efficacy. Sodium salicylate (1 drachm to the ounce) has also been recommended in the confluent form, to be applied four or six times daily, especially after eating. Dr. J. Lewis Smith advises the appli-

[1] *Lehrbuch der Kinderkrankheiten*, Zweite Auflage, 1887, p. 595.

cation of iodoform in ethereal solution (2 drachms to the ounce), to be applied with a brush. If repair goes on slowly other astringents may be used. Among those most recommended are a solution of cupric sulphate (10 grains to the ounce), zinc sulphate (10 to 20 grains to the ounce), and potassium chlorate (10 grains to the ounce). In children small doses of potassium chlorate, largely diluted, may be given at intervals during the day. Any gastric or intestinal derangement must be rectified.

Stomatitis Parasitica.

In stomatitis parasitica, commonly known as thrush, there is an inflammation of the mouth due to the growth of a parasitic cryptogamous plant upon and between the layers of the epithelium. Its growth is favored by the existence of previous catarrhal inflammation or by any of the conditions tending to favor such an inflammation; by any undue acidity in the secretions of the mouth; and by debilitated states of the system. It develops most readily on epithelium of the squamous type, its mycelium penetrating between the individual cells and their several layers. The affection, with its concomitant inflammation, is entirely due to the presence of this parasite, on the removal of which the irritation quickly ceases and the parts resume their natural condition. Our efforts must therefore be directed to its destruction. To reach it, it is necessary to remove the upper layers of epithelium, and in doing so a certain amount of force is necessary. It will be found that the removal is more easily accomplished if the wash is rendered slightly alkaline.

The following solutions may be used: Bicarbonate of sodium, 15 grains to the ounce; borax, 30 to 40 grains to the ounce; or sulphate of sodium, 1 drachm to the ounce. Some physicians still prefer the use of borax and honey (sodii borat., 1 drachm; mellis, 3 drachms), gently pencilled over the spots where the growth appears; but as all saccharine solutions favor the growth of the parasite, it would seem as if the addition of either honey or syrup to these solutions can only be harmful. Should the surrounding mucous membrane appear very red and inflamed, a solution of silver nitrate (3 to 5 grains to the ounce), gently pencilled over the surface, will be found of much service, and if any small spots of ulceration appear in the denuded portions, they may be lightly touched with a probe armed with the mitigated stick.

In addition to efforts directed to the actual removal of the parasite, great care must be taken to place the patient under the most favorable hygienic conditions. If the infant is fed artificially, special instructions must be given to ensure absolute cleanliness in the preparation of food and in the feeding-apparatus. Feeding-bottles with tubes should be

discontinued, as they are impossible to keep clean. The food should be sufficiently nourishing and yet digestible, and should be given at regular intervals, while both before and after feeding or nursing the mouth should be thoroughly but gently cleansed with a weak alkaline solution. It must always be remembered that, as the disease is parasitic, the germs can be easily conveyed from one child's mouth to another's. In foundling and maternity hospitals constant care must be exercised in the inspection of each child's mouth, and no transference of bottles from child to child should be allowed. If the disease attains any headway, not only does the act of sucking become very painful, but deglutition may be rendered both difficult and painful, while in some few cases the œsophagus has been reported as blocked with masses of confervoid growth and epithelium. As it is extremely important that the nutrition of the child should be sustained, its nourishment must be given in a concentrated and more or less predigested state. Wiederhofer recommends in severe cases the administration of food through a funnel or tube inserted into the anterior nares; deglutition will be excited in a reflex manner when the milk or other fluid reaches the pharynx. Forchheimer[1] reports a case of œsophageal obstruction in which he was able to force a catheter gently through the mass of mycelium and spores into the stomach, and through it introduce some nourishment. Vomiting was induced and masses of the growth were thrown up.

In adults we may use the foregoing solutions as washes or sprays. Should there be much surrounding congestion of the mucous membrane, it is advisable to use the solution of silver nitrate early. As thrush occurs in adult life only in very debilitated conditions, its appearance is always an unfavorable omen, and prompt but gentle measures should be at once taken for its eradication. Forchheimer[2] says that calomel in small doses, or corrosive sublimate very much diluted, almost always acts as a specific in intestinal troubles which are due to thrush. The underlying conditions or disease in every case of thrush should receive the most careful attention.

Ulcerative Stomatitis.

In stomatitis ulcerosa there is severe inflammation of the mucous membrane, commencing generally at the free border of the gum, evincing a tendency to extend in all directions and to affect the deeper tissues, frequently loosening the teeth, and in severe cases leading to necrosis of the bone. A foul state of the mouth, due either to want of cleanliness or diseased teeth, is a strong predisposing cause, especially when associated with unhygienic conditions of life tending to depress the system, such as impure air, unhealthy food, and improper clothing. The inflammation gives rise to profuse salivation, which, mingling

[1] *Archives of Pediatrics*, Feb. 7, 1889. [2] *Loc. cit. et supra.*

with the discharges from the ulcerated surface, becomes bloody and fœtid, and if swallowed may disturb both the stomach and bowels. Fortunately, we have in potassium chlorate almost a specific for this affection. It may be administered both as a gargle (10 to 15 grains to the ounce) and internally. The salt gives rise to some smarting pain when passing over the inflamed surface, but this is only momentary, and may be partly obviated by giving it in some demulcent fluid, such as mucilage of slippery elm or sassafras-bark, or associated with extract of liquorice. In addition to this, the patient must be ordered soft, digestible food, and, if possible, obtain plenty of fresh air. The functions of the stomach and alimentary canal must be maintained in a healthy state; afterward tonics, some suitable preparation of iron and quinine, and cod-liver oil, may be administered. Under this treatment the symptoms, as a rule, rapidly improve, the salivation diminishes, and the fœtid odor passes away. Sometimes, however, the fœtor is so great that it is desirable to have it lessened more rapidly. To this end some of the more distinctly antiseptic washes may be used alternately with that of the potassium chlorate, such as solution of potassium permanganate (2 to 4 grains to the ounce), solution of carbolic acid (5 grains to the ounce), solution of peroxide of hydrogen (1 to 3 drachms to the ounce), or listerine. Sometimes, although rapid improvement is made at first, yet the gums still remain in an unhealthy and spongy state, and the patient may complain of some slight fœtor, detectable during the night or early morning. In such cases it is desirable to pencil the gums lightly with an astringent solution. Perhaps none is better than the silver nitrate (10 grains to the ounce). Glycerin of tannin, solution of alum (15 grains to the ounce), or tincture of iodine may sometimes be of much service. If the disease still lingers, examine the teeth, and if any appear loose or the roots are diseased, it will be better to have them removed promptly. Necrosed bone must receive prompt surgical attention. Even after all the symptoms have passed away the physician must warn the patient to maintain due care and cleanliness for some months, lest relapse occur. In some children with every feverish disturbance of the system the affection returns. In such the germs have evidently not been thoroughly eradicated, and still linger in some of the recesses of the mouth. The persistent use of antiseptic washes and careful attention to the teeth will in time overcome the tendency. In scrofulous children we are apt to have a good deal of associated adenitis. If the inflammation is associated with acute rickets or scurvy, it rarely gets well until the constitutional symptoms are removed.

Occasionally the disease assumes a chronic character from the outset. The inflammatory symptoms are but slightly marked, there is no notice-

able increase in the salivation, and fetor may be noticed only at intervals during the day. Such cases are but slightly amenable to the action of the potassium chlorate; for their cure they require good hygiene and regular cleansing of the mouth and teeth, while three or four times weekly the inflamed portion may be carefully pencilled with one of the astringent solutions mentioned above, preferably the silver nitrate. These cases require perseverance in treatment for some months, else frequent relapses will occur. It must always be borne in mind that this disease is contagious, and effective isolation must be maintained when it occurs in a family or in an institute.

Gangrenous Stomatitis.

In stomatitis gangrenosa we have to deal with a rapidly-spreading necrosis of the cheek, lip, or gum occurring in debilitated children, generally under unfavorable hygienic conditions, and oftentimes as a sequel to one of the eruptive fevers. Beginning at first in the inside of the mouth, its onset is apt to be unnoticed till a pungently fetid odor attracts attention, when a sloughy-looking ulceration with a hard infiltrated base will probably be seen on the inside of the cheek or lip near the angle of the mouth. This rapidly, almost hourly, extends, so that within a day or two a large portion of the cheek, gum, and lip may be converted into a fetid dark-brown mass. The vital powers are rapidly prostrated; the child becomes apathetic and refuses to take nourishment, and very shortly a septic broncho-pneumonia or diarrhœa terminates the case. Treatment must be prompt, and the first indication is to arrest, if possible, the destructive process, and substitute for it a healthy action. It is generally recommended that this be accomplished by the application to the affected part of one of the stronger acids, either nitric or hydrochloric, or of the actual cautery (Paquelin's or the galvanic). The application should be thorough and complete at first; short of that, the irritation induced may only favor the spread of the disease. By many the preference is given to the cautery, as being more under control, while its power of destruction is complete and immediate. Before using it the patient should have an anæsthetic, and all necrotic tissue should be removed with forceps and scissors. It is recommended that the operation be repeated as often as may be necessary, but not more frequently than once in twenty-four hours. After each cauterization the parts will be thoroughly washed with some antiseptic lotion (solution of mercuric chloride, 1 : 1000; solution of carbolic acid, 1 : 20; or solution of zinc chloride, 20 grains to the ounce;) then dusted with iodoform, iodol, or aristol, and a charcoal poultice applied. Many physicians, however, prefer less heroic treatment, and can apparently point to many successful cases in justification of their opinion. Dr. J. Lewis

Smith[1] recommends from trial the formula given by Drs. Evanson and Maunsell, quoting from their article as follows: "The lotion which we have found by far the most successful is a solution of sulphate of copper, as employed by Dr. Coates in the Children's Asylum. His formula is as follows:

R. Cupri sulph.,	ʒij;
Pulv. cinchonæ,	℥ss;
Aquæ,	f℥iv.—M.

This is to be applied twice a day, very carefully, to the full extent of the ulceration and excoriations. The addition of the cinchona is only useful by retaining the sulphate of copper longer in contact with the edges of the gums." Dr. Smith adds: "A moment's reflection will show us that the above treatment is preferable, provided it is equally effectual in arresting the gangrene, to the treatment by the strong acid." Gerhard believes the best local application is the nitrate of silver if the slough is small in extent. If much larger, the best escharotic is the solution of iron perchloride, applied in an undiluted state. Dr. Scheck[2] says, "If sloughs are formed, they must be removed by scissors or knife, and an attempt made to restrict the further progress of the disease. Mineral acids, chloride of iron, and the actual cautery were formerly used for this purpose, but now the nitrate-of-silver pencil is rightly preferred. The pencil should be slightly pointed, and methodically pushed from one part of the slough to another till it comes against resistant tissue. This manipulation is to be repeated till the gangrene is limited or ceases." In a case mentioned by Lange the gangrene healed very quickly after the application of lint saturated in turpentine and changed frequently. Dr. C. J. Maguire[3] reports several cases treated successfully by the application locally of bismuth subnitrate. The mouth was washed every three hours with a solution of carbolic acid, and the bismuth dusted on afterward. Under this treatment, with the administration of iron and a generous diet, his patients recovered, although some of them seemed almost hopeless in the beginning. Dr. Sullivan[4] reports the successful use of a mixture of equal parts of liquor ferri subsulphatis and glycerin as an application. The necrosed portions were first removed; the mouth was then thoroughly washed with a solution of sulphate of copper (30 grains to the ounce), and afterward the subsulphate was painted over the affected part. The operation was repeated four times a day. In each case the gangrene was arrested within three

[1] *Dis. of Children*, 7th ed., p. 148.
[2] *Dis. of Mouth, Throat, and Nose*, trans. by R. H. Blaikie, Edin., 1886, p. 31.
[3] *N. Y. Med. Record*, Feb., 1883. [4] *N. Y. Med. Journal*, Aug. 23, 1890.

days after the first application. Treatment was continued for eight or ten days, and recovery was complete within two weeks." Dr. J. Lewis Smith[1] writes, "If, after employing the milder treatment for two or three days the gangrene continue to spread, strong muriatic acid should be cautiously applied by a camel's-hair pencil or small swab in such a way that it comes in contact only with the diseased surface. Its use should be immediately followed by an alkaline wash. Recently in the Foundling Asylum carbolic acid has been used as an escharotic in one or two cases, instead of the strong acids, and with such a result as to encourage its further use."

In addition to attacking the destructive process by one of the foregoing methods, it is necessary, above all things, to sustain the strength of the patient. Stimulants may be allowed as freely as can be borne, and concentrated foods, predigested if necessary, should be administered at frequent intervals. If unable or unwilling to take nourishment by the mouth, predigested food must be given *per rectum*. Septic infection must, as far as possible, be guarded against by frequent cleansing of the mouth and wound with one of the antiseptic washes (among the best are the solution of peroxide of hydrogen and Labarraque's solution, 2 drachms to the pint.) and afterward dusting with powdered charcoal, bismuth subnitrate, or aristol. If possible the child's head must be placed in a position to permit the freest possible evacuation of the discharges. Internally, Dr. West[2] recommends the use of potassium chlorate, principally for its topical action; caution should be exercised that a safe dose be not exceeded. Ferruginous tonics may undoubtedly be of service, and if well borne by the stomach tincture of the chloride of iron appears the most suitable, and should be given in large doses, frequently repeated. When the gangrene is arrested and the granulations begin to present a healthy appearance, the danger is usually past and convalescence is established rapidly. To favor the healing mild stimulating lotions are indicated—solution of boric acid (15 grains to the ounce), solution of zinc sulphate (2 grains to the ounce), or an ointment may be used containing 2 drachms of balsam of Peru and 1 ounce of vaseline. Care must be taken during the slow process of healing that adhesions do not form which would interfere with the movements of the mouth.

Mercurial Stomatitis.

Severe stomatitis, due to the toxic action of mercury administered therapeutically, is seldom met with in our day. As a rule, it may be prevented by the administration of potassium chlorate and by taking due precaution to ensure thorough hygiene of the gums and teeth. Mild cases subside on the withdrawal of the drug. If patients appear

[1] *Loc. cit.* [2] *Diet. Diseases of Infancy and Childhood*, 6th ed., London, p. 590.

very susceptible to its action and the symptoms appear threatening, it is a wise precautionary measure to have them removed from all possible influence of the mercurial preparations. If fumigations have been employed, the room in which they were taken should be abandoned. Locally, a similar treatment to that indicated in catarrhal stomatitis is called for. The mouth may be frequently rinsed out with warm, soothing washes (*vide* Catarrhal Stomatitis), to which, if there is much pain, opium may be added. Fetor of breath may be relieved by the use of washes containing hydrogen peroxide (1 drachm to the ounce), Labarraque's solution (1 drachm to the ounce), or potassium permanganate (2 grains to the ounce). Internally, potassium chlorate may be given in 5- or 10-grain doses every three hours, either combined with tincture of chloride of iron or in decoction of cinchona. Should any ulcerations be present, they may be gently brushed with the solution of silver nitrate. The strength must be maintained by careful feeding, or, if necessary, by enemata.

Stomatitis Crouposa and Stomatitis Diphtheritica.

These call for no special treatment beyond that directed to the more important affection, and the reader is referred to the special article on Diphtheria.

ABNORMAL DENTITION.

Very rarely it happens that an infant is born into the world with one or two teeth already appearing in the gum. Such teeth are liable to irritate the mother's nipple severely, and we may be asked to remove them. This can be easily done if they are only connected to the gum by mucous membrane; but when they are set more tightly the operation becomes more serious, from the possibility that it may be followed by troublesome hæmorrhage which may be difficult to control. It will be a question in such a case, also, whether we might not be removing the infant's temporary incisors, which would not be replaced till the child reached its sixth or seventh year. For these reasons their removal is not to be recommended.

Many infants, especially those who are of a weak or nervous constitution, are liable to evince symptoms of irritation during the period immediately preceding or at the time of the eruption of the temporary teeth. At these times the infant may become peevish and fretful; its sleep be disturbed; there may be more or less pyrexia; and its digestion may be easily upset. With these symptoms a warm bath (85°–90° F.), in which the infant may remain about ten minutes, has often a very soothing effect, and if given shortly before its sleeping-time may induce a quiet and restful sleep. At the same time a mixture containing 1 or 2 grains of potassium bromide, with $\frac{1}{8}$ to $\frac{1}{4}$

drop of tincture of aconite to the dose, to be repeated every two hours, may assist the action of the bath. The greatest care at this time must be given to the infant's diet, which should be simple, digestible, and carefully adapted to its age. Over-feeding is to be avoided, and as far as possible regularity in feeding is to be maintained. The gums may be frequently examined for symptoms of stomatitis. If hot and tender, frequent applications of cold water or weak solutions of sodium bicarbonate (5 grains to the ounce) or sodium borate (10 grains to the ounce) should be made. Solution of cocaine (2 grains to the drachm), lightly brushed over the inflamed gum, has been spoken of highly, and may give temporary relief. When the gum is tense, tumid, and painful I have thought that lancing of the gum has sometimes given relief to the infant. The former measures are, however, to be preferred under ordinary circumstances. Many serious ailments have been referred to dentition as an effective cause. I would strongly urge the most careful physical examination and thorough sifting of evidence before such an unlikely supposition is admitted.

Dentition may be delayed and the deposit of enamel may be defective in infants suffering from rickets, or as a consequence of any severe illness affecting nutrition profoundly. The importance of good teeth to the growing child cannot be over-estimated. Little benefit is apparently to be derived from administering any of the so-called proximate principles of the tooth, but distinct advantage is obtained when we can improve general nutrition. To this end, in addition to abundance of fresh air and suitable food, cod-liver oil should be administered in doses easily assimilated. To this wine of iron or the ammoniated citrate may be added if there is any anæmia. The following is a useful formula for an infant of one year:

℞. Ferri et ammonii cit., ℥ss;
Ol. morrhuæ, f℥j;
Pepsin. glycerit., f℥ij;
Pulvis acaciæ,
Pulvis sacch. alb., *āā*. ℥ij;
Aquæ, q. s. ad f℥iv.—M.
Sig. One tea-spoonful three times daily.

Suppurative Inflammation of the Gums.

This is known commonly as gum-boil or alveolar abscess. We have a localized inflammation, commencing generally on the dental periosteum at the bottom of a carious fang. It is very liable to go on to the formation of pus, which produces absorption of the alveolar wall, then breaks into the submucous tissue of the gum, and finally points at some place on the mucous membrane within the mouth. Treatment, if

possible, should be early. If the tooth be too much damaged to repair, it had better be extracted at once. If it can be saved, the diseased pulp in the fang should be removed, and the canal in the root cleared and thoroughly cleansed with antiseptic agents, then secured by temporary filling. At the same time, a preparation of iodine or iodine and aconite may be applied to the gum externally, or, if thought better, an incision may be made over the site of the inflamed root down to the periosteum. When suppuration has occurred in the fang-cavity an effort may still be made to secure its removal through the canal of the fang, but if it has burst through the alveolar wall its early evacuation into the mouth is demanded.

AFFECTIONS OF THE SALIVARY GLANDS.

Increased Salivation.

This is produced by any source of irritation in the mouth, and is therefore a frequent accompaniment of most of the inflammatory diseases above mentioned. It may, however, apparently arise from distant irritation, and has occasionally been met with in affections of the stomach, bowels, and uterus; rarely it has occurred as a symptom of lesion in the medulla oblongata or of the facial nerve. Occasionally it has been met with in otherwise healthy children between two and eight years of age apparently free from constitutional or local disease. In these latter cases it must be regarded as a neurosis. When arising from a known exciting cause our efforts will of course be directed to the removal of the source of irritation. In salivation of a neurotic form most benefit will probably be derived from the administration of iron or arsenic; at the same time belladonna may be used as a palliative with much probability of success. Dr. Finlayson reports a case of idiopathic salivation in a strong, healthy child of six years which was cured in a month by $\frac{1}{4}$ of a grain of extract of belladonna taken three times a day. Atropine sulphate may be used similarly in doses of $\frac{1}{120}$ to $\frac{1}{200}$ of a grain. If these fail, other nerve-sedatives may be tried, such as opium, chloral, or potassium bromide. The nutrition at the same time must be carefully maintained.

Dryness of the Mouth.

This condition is often a source of much discomfort, and does not yield readily while the cause is in operation. Sometimes small doses of potassium iodide give a certain amount of relief. Dr. Blackman recommends the use of $\frac{1}{20}$ of a grain of pilocarpine in a gelatin lamella, allowed to dissolve on the tongue, previously moistened by a

sip of water. He reports this as producing a slight flow of saliva for twenty-four hours, unaccompanied by excessive perspiration. The following is also a good formula for the administration of the same drug in the form of a lozenge:

℞.	Ext. pyrethr. fluid.,	♏ij–iij;
	Pilocarpinæ,	gr. $\frac{1}{32}$;
	Pulv. glycyrrhizæ,	gr. ij;
	Pulv. acaciæ,	gr. ij;
	Glycerini,	♏j;
	Sacchari,	gr. xx.

Mix well, and make into one lozenge, to be allowed to dissolve slowly in the mouth.

Idiopathic Parotitis.

Idiopathic parotitis is a condition commonly known as "mumps," in which we have to deal with a constitutional disease manifesting itself locally in an inflammation of the parotid gland; very rarely its associated glands, the submaxillary and sublingual, are also affected; occasionally it attacks, either by metastasis or as a sequence, the testicle in the male and the mamma or the ovary in the female. Constitutional disturbance is generally only slight, but sometimes the pyrexia runs high and pain is severe. The treatment in mild cases may be expectant. For the first few days at least, especially if the weather is cold and changeable, the patient should be confined to bed. The inflamed glands should be protected from the air by a layer of cotton wool secured by a silk handkerchief or light bandage, and gentle saline laxatives may be administered. If the patient is just reaching adolescence, there is perhaps more danger that the testicles or ovary will be attacked, and in such cases more caution must be exercised. Rest in bed for a week, or even ten days, would be the more prudent. If there be much pyrexia and local pain, tincture of aconite (U. S. Ph.) may be given in 2-drop doses for an adult every three hours, while locally to the swelling a mixture of extract of belladonna and glycerin may be applied and covered with oiled silk and cotton wool. If there is much restlessness at night, chloral or potassium bromide may be administered. I have several times used in these cases phenacetin or antipyrine in 5- to 10-grain doses twice daily, with considerable relief to the symptoms. Owing to the pain in movement of the jaw all nutriment should be given in soft, if not in liquid, form. In the early stages milk foods and light broths should be given; afterward, as there is a marked tendency to subsequent anæmia, the food should be more stimulating, and ferruginous tonics, with quinine and cod-liver oil, may be administered. Should

there be any indication of metastasis, the venous return in the affected part must be favored by position. In females a hot douche or sitz-bath may be taken. Leeching has been recommended as of service in relieving the pain of orchitis or ovaritis; four to six leeches may be applied to the inner border of the groin. Symptoms of meningeal irritation are occasionally met with, and must be combated by cold to the head and the administration of from 15 to 30 grains of potassium bromide, with tincture of aconite, every three to six hours, according to the severity of the symptoms. Rarely the swelling in the parotid becomes tense, red, and very painful, and the inflammation goes on to suppuration. In such cases poultices must be applied, and an incision made early in a horizontal direction parallel to the line of the important vessels and nerves, using caution to avoid them. In strumous children enlargement of the gland sometimes persists for weeks. Nerve-deafness following parotitis is usually incurable.

Secondary parotitis occasionally occurs as a sequel to other infectious diseases, especially those characterized by profound prostration. At the onset the application over the inflamed gland of lint dipped in the belladonna-and-glycerin mixture and covered with oiled silk and cotton wool may be of service. Should suppuration threaten, poultices must be applied and an early exit given to the pus, the cautions mentioned above being observed.

AFFECTIONS OF THE TONGUE.

Burns and Scalds.

These seldom call for much medical treatment. Sometimes the soreness persists, when a demulcent wash, rendered slightly alkaline by the addition of sodium bicarbonate or borate, and, if necessary, with a small amount of opium, may be used. Butlin recommends pencilling the affected surface with borax and honey. The sucking of small lumps of ice is generally very grateful.

Stings and Bites.

Such accidents are not often met with. A weak solution of ammonia may be used as a mouth-wash for the first day or two, in the hope of neutralizing the formic acid, the active principle of the poison. It may be afterward followed by a demulcent mouth-wash containing sodium bicarbonate (10 grains to the ounce), or by one containing salicylic acid (2 grains to the ounce).

Acute Glossitis.

Here we have to deal with an inflammation arising very suddenly, generally in persons whose health is more or less impaired. In its severer forms it seriously threatens life by the very great interference with respiration and deglutition. The symptoms generally reach their height on the third or fourth day, and terminate by resolution about the fifth or seventh day. In its milder forms glossitis demands little active interference beyond a smart saline purgative, and, topically, cool emollient mouth-washes, such as mucilage of slippery elm, of gum arabic, or quinceseed. To these may sometimes be advantageously added sodium borate (5 to 20 grains to the ounce) or alum (5 grains to the ounce) or ammonium chloride (20 to 30 grains to the ounce). If grateful to the patient, ice in small pieces slowly sucked may be of much service. If the symptoms are more threatening, free leeching may be employed between the hyoid bone and the angle of the jaw, followed by poultices to encourage oozing. If there is much swelling and both respiration and deglutition are seriously interfered with, Butlin[1] strongly recommends two free incisions into the substance of the tongue from behind forward, one on each side of the raphé, distant from it about two-thirds of an inch. They should be carried to the depth of about one-third of an inch, and can be best made with a very sharp bistoury, inserted into the mouth on the flat and then turned. The hæmorrhage is never serious unless the incision has been carried too deeply, and the moderate bleeding which occurs is decidedly beneficial. These incisions may appear deep at the first, but they become quite shallow when the organ has shrunk. Sometimes the inhalation of atomized water proves decidedly grateful. The water should not exceed the temperature of 160° F., and may be rendered perhaps more effective by the addition of compound tincture of benzoin. The application of a solution of chloride of ammonium (1 drachm to the ounce) through the steam-spray apparatus has sometimes proved very effective in favoring resolution (Cohen). The spray should be used for fifteen or twenty minutes at a time and repeated every two or three hours.

Sometimes the process goes on to suppuration, prolonging the duration of the disease and much increasing the local distress. Demulcent washes should be used as warm as can be comfortably borne, and as soon as the presence of pus can be detected free incision must be made and the abscess-cavity thoroughly washed out with some antiseptic solution. In these cases the pus is usually fetid. Very rarely gangrene sets in, due generally to irritation from sharp or carious teeth. Such a condition will demand the greatest tenderness, and washes or sprays of

[1] *Diseases of the Tongue*, by H. T. Butlin, F. R. C. S., London, 1885, p. 42.

a solution of hydrogen peroxide, potassium permanganate, boric acid, or carbolic acid should be used at frequent intervals. Occasionally, when the swelling is very great, much difficulty is experienced in feeding the patient. This can sometimes be done by means of a tube through the nasal passages; at the same time predigested nutrient enemata must be carefully given. After resolution has taken place sufficiently to permit deglutition, ferruginous tonics, with quinine, should be administered, and of these the best is probably the muriated tincture of iron with glycerin. The chronic inflammatory thickenings which sometimes remain after an acute attack are not very amenable to treatment. If any source of irritation can be discovered in a sharp or carious tooth or an offending plate, it must be at once remedied; at the same time the spot may be painted with a weak solution of iodine. The general hygiene of the mouth must receive careful attention and all irritants must be avoided.

Occasionally *unilateral glossitis* is met with. It generally runs a mild course, and seldom demands the severer methods mentioned above.

Chronic Superficial Glossitis.

Chronic inflammation of the mucous membrane of the tongue is met with occasionally in persons subject to dyspeptic troubles or as the result of irritation produced by spirits, especially when taken raw, by tobacco, both smoking and chewing, by irregular or carious teeth, and by the frequent use of too hot or too cold drinks. The inflammation appears to affect principally the papillæ and mucous glands, leading in places to their almost entire disappearance. The mucous membrane generally is reddened, and very sensitive to any irritation. Occasionally the surface of the tongue appears as if it were mapped out in a series of more or less ovoid patches, smooth and glossy because denuded of papillæ, and separated by furrows or fissures reaching almost to the basement membrane. Conditions of this character are particularly difficult of treatment. The diet must be of the blandest character. It is sometimes desirable to confine the patient entirely to milk diet. Spirits and tobacco give rise to great distress, and must be entirely abstained from. The greatly-increased sensibility of the surface renders it very liable to frequent exacerbations; there must, therefore, be no relaxation in the absoluteness of the dietary. Should exacerbations occur, we may find the process go on to ulceration in places—a condition still more difficult to manage. The general health must be maintained at its highest level, but in the administration of tonics no irritating drugs should be allowed. Should there be much pain, demulcent mouth-washes to which opium has been added must be employed. Of local remedies, those which appear to relieve the patient more certainly and quickly than any others are solutions of chromic acid (5 to 10 grains

to the ounce) or the mel boracis of the Pharmacopœia (Butlin). It may be applied twice daily, gently brushed over the surface with a camel's-hair pencil. At the same time great care must be taken to have the mouth thoroughly cleansed after each meal. For this purpose Seiler's antiseptic and alkaline tablets may be used, one dissolved in a gill of tepid water, or the following:

℞. Sodii salicylat.,
Sodii borat., āā. gr. x;
Acidi carbolici, gr. j;
Glycerini, f℥i–℥ij;
Aquæ rosæ, q. s. ad f℥j.—M.
Sig. Use frequently.

Occasionally a chronic ulcer in the centre of a plaque of this chronic inflammation resists all treatment. Such cases may be rendered more endurable and the spot less sensitive by the application of glycerin of tannin or the solution of chromic acid. The application of any severe irritant or caustic should be avoided, for it must always be borne in mind that a considerable percentage of these cases terminate in epithelioma. The physician should therefore keep the patient under his inspection.

Leucoma.

Closely allied to the foregoing in its pathology and etiology is the condition known as "smoker's patch," and the more extensive, but very similar, affection known as leucoma or leucoplakia oris. Both of them may be said to be the expression of an irritant acting on a sensitive mucous membrane. In the smoker's patch we have a chronic inflammation of the small spot of mucous membrane where the pipe generally rests. At first there is only a slight thickening of the deeper layers of the epithelium. Afterward these peel off, leaving a spot between a quarter and half an inch in diameter, smooth, red, and looking as if denuded of papillæ. If seen thus early, soothing measures should be employed. If smoking is not altogether abandoned, the smoothest form of pipe must be used, and only the mildest tobacco, while the pipe should be placed on the opposite side of the mouth to which it has been previously used. The patch may be brushed twice daily with a weak solution of chromic acid. If the disease still shows signs of extension, tobacco and spirits in any form must be absolutely forbidden. All irritating articles of food must be excluded from the diet, which should be bland and simple in character, but nourishing. Any gouty, rheumatic, or dyspeptic condition must, as far as possible, be corrected. Topically, the spot must be brushed three or four times daily with the solution of chromic acid or with borax and honey, or with a weak solution of silver nitrate (10 grains to the ounce).

In leucoplakia oris we have either a more extensive distribution of minute patches very similar in character to leucoma, or we may have a large patch, white or bluish white in color, covering the greater portion of the dorsum; the inside of the cheeks and lips are also liable to be affected. The treatment of all these conditions must be very similar—the absolute withdrawal of all sources of irritation, a bland, unstimulating diet, and the employment of soothing mouth-washes. As a rule, the alkaline lotions give more relief in leucoma than any other application. The following may be used: potassium bicarbonate, 15 to 20 grains to the ounce; sodium bicarbonate, 20 grains to the ounce; sodium borate, 20 grains to the ounce.

Sometimes a very weak solution of alum (20 grains to the ounce) agrees well, or a solution of sodium chloride of the same strength. It will require careful trial to decide which remedy suits the special case, and when the tongue is very sensitive many trials may have to be made before the one which gives most relief is found. One general rule holds good for all cases of leucoma; namely, not to use caustics. Whatever danger there may be of the development of carcinoma is certainly increased by the employment of silver and other caustics (Butlin).

As regards general treatment, any debility or diathesis must receive special attention. If a cutaneous rash coexists, liquor arsenicalis may be of distinct benefit.

In connection with the above, Butlin says: "Warty growths appear to be the most dangerous of the conditions which actually and immediately precede cancer. I have no doubt that indurations and warty growths and very obstinate ulcers, particularly when they present the slightest increase of induration about their bases, ought to be removed freely and without delay by the knife."

Wandering Rash.—Occasionally in children a peculiar circinate but migratory rash is seen on the dorsum of the tongue. It does not appear to be due to any constitutional diathesis, nor is it associated with any local disorder that can be made out. It has no symptoms of its own. The condition does not seem to be affected by any medicines that have been given nor by any change in diet. Butlin says of it: "Unless the future brings with it a very different experience to the past, I shall continue to believe that this wandering rash is clinically a very insignificant disease, never likely to become serious, and that it undergoes spontaneous cure after it has existed a considerable period."

Black Tongue.—Very rarely a black discoloration, commencing about the middle of the dorsum, is met with, which gradually extends over the surface till it covers the greater portion, then in a few weeks it gradually disappears. It is apparently due to some parasitic condition. In its treatment there is little to be done. Many washes and local applications have been used without any permanent benefit.

The patients generally appear to be in poor health, and tonics given to improve it have seemed to exert a good effect. The discoloration is not accompanied by local symptoms.

Ulcers.

Occasionally, grouped about the neighborhood of the tip of the tongue, may be seen a few small superficial ulcers, very tender and irritable; sometimes with sharp-cut edges, at other times less defined. They are generally met with in patients who suffer from gastric irritation. As a rule, they yield readily to an unirritating diet, stomachics, or gentle laxatives and a soothing gargle. If they persist, their surface should be gently brushed with a solution of chromic acid (5 grains to the ounce) or silver nitrate (10 grains to the ounce).

Ulcerated surfaces and fissures, simple in character, due to the irritation of some offending tooth or artificial plate, are occasionally met with. The source of irritation must be removed at once, and the raw surface gently washed with some weak antiseptic lotion, as solution of boric acid (10 to 15 grains to the ounce). If there is much pain, the following lotion may be brushed over the surface several times daily:

℞. Chloralis,	gr. x;
Glycerini,	gr. x;
Aquæ,	q. s. ad f℥j.—M.

If the progress toward repair is slow, the edges may be touched lightly with a stick of silver nitrate or the surface may be brushed with a solution of chromic acid (10 grains to the ounce) or of (sulphate of copper of the same strength). Butlin warns against the over-irritation of a sore of this character in persons more than fifty years of age, lest it may develop into carcinoma. Should it persist notwithstanding these measures, the best course will be to have it removed, and with it an area of at least one-quarter of an inch of healthy tissue. The general health should receive attention.

Syphilis.

The manifestations of syphilis are very frequently met with in the mouth. Here, as in all forms of syphilis, constitutional treatment must play the most important rôle, and the reader is referred to the article on that subject. It will be sufficient to add that in those forms of the disease in which little local damage occurs it will be only requisite to use that form of treatment which suits the general disease; but when we have to deal with rapid destruction of tissue, as met with occasionally in phagedenic ulceration, the quickest possible results are

to be obtained. Not frequently do we meet with a *primary sore* on the lips or tongue as the result of infection from some unclean substance conveying contagion, such as pipes and cigars, or from kisses by persons with an infectious sore on the lips. In the treatment of these the principal reliance must be placed on mercury, administered for its constitutional effects. At the same time we may use soothing applications to the sore itself. A lotion of black wash is often very suitable, or the sore may be dusted lightly with powdered calomel. Should it show symptoms of any phagedenic action, the application of nitric acid may be called for.

Of the *secondary manifestations*, mucous patches are very frequently seen on the inside of the lips, especially the lower lip; on the inner surface of the cheek, often in the neighborhood of the last molar teeth; and on the sides of the tongue. *Fissures* may occur at the angles of the mouth in connection with the mucous patches on the inside of the lip, and at the borders and tip of the tongue, where it is exposed to the friction of the teeth, ulceration may take place. These lesions, as a rule, are readily affected by local treatment, but very slowly yield to constitutional measures only. Butlin says: "I have treated patients with mercury for several months in succession without curing or greatly altering the sore places on their tongues. With the mercury I have then employed local treatment, and have seen the sore places disappear within a week. Again, I have treated the patients with the same local measures from the commencement, and have cured the sores within a week or ten days. On this account I look on local treatment as essential to the rapid cure of these affections." He strongly recommends the application of a solution of chromic acid (10 grains to the ounce), which he directs to be painted over the affected part three or four times a day by means of a camel's-hair brush. Scheck[1] directs the patches to be touched with a stick of silver nitrate, and afterward prescribes mouth-washes containing chlorate of potassium, tincture of rhatany, or boric acid. Cohen calls nitrate of silver the sovereign local remedy for all syphilitic ulcerations of the mouth. Many surgeons, however, prefer the light application of either the pure nitric acid or the solution of acid nitrate of mercury. In addition to local applications, the physician must insist on complete abstinence from the use of tobacco in any of its forms, and the mouth should be kept in a cleanly condition by the use of some slightly alkaline and antiseptic wash, used regularly after each meal, such as a solution of Seiler's antiseptic tablets.

Tertiary syphilis manifests itself in the oral cavity by gummata and scleroses. To the breaking down of the gummata, either superficial or deep, is due the formation of the ulcers and fissures which are met with in this stage of the disease. Gummatous ulcers may remain in

[1] *Loc. cit.*

an indolent condition for long periods. Such ulcers require careful stimulation, and perhaps the nitrate-of-silver solution (20 to 30 grains to the ounce) forms one of the most effective applications if carefully brushed over the surface. At times the ulcers become inflamed and extend or become phagedenic, eating away a large portion of the tongue. In such cases the constitutional treatment must be pushed, and the dose of the iodide, if well borne, should be increased to 20 or 30 grains, or even a drachm, three times a day. At the same time, tonics, such as quinine and cod-liver oil, may be ordered. Locally, gentle cleansing applications will probably be best borne, such as boric acid or weak solutions of chlorate of potassium (10 grains to the ounce). Occasionally potassium iodide is not tolerated. In these cases sometimes one large dose given through the day agrees better than the divided doses. If this plan fails, recourse must be had to mercury. Butlin[1] recommends solution of mercuric chloride, with the insufflation of a powder containing finely-powdered iodoform 1 grain, morphine $\frac{1}{6}$ grain, powdered borax or oxide of zinc 3 grains. Before the powder is applied the surface of the ulcer or fissure must be carefully cleansed with a warm solution of mercuric chloride (1 : 2000), then dried, and the powder insufflated thickly over every part of the sore.

In the scleroses of tertiary syphilis, if seen before contraction takes place, much improvement is to be expected from potassium iodide: 10 or 15 grains three times a day, with or without small doses of mercuric chloride, may be given to commence with, and if a decided effect is not speedily produced, the dose may be increased rapidly to 25 or 30 grains. Local treatment is not necessary. If contraction has taken place, no treatment will be of much avail beyond the palliation of symptoms as they arise.

Tuberculosis is frequently met with in the posterior parts of the mouth as a secondary manifestation of disease elsewhere. In these cases this local manifestation rarely gives rise to important symptoms. Any irritation arising may be relieved by the application of astringent or anodyne washes or sprays. Occasionally, however, we meet with localized areas in the anterior part of the mouth, generally on the tip of the tongue or on the upper surface of one side, appearing in their early stage as small circumscribed nodules. These may be secondary to disease elsewhere, but occasionally appear to be primary. The mucous membrane over these nodules sooner or later ulcerates, leaving deep ulcers with overhanging edges. These maintain their atonic character, rarely heal, and gradually extend, and are a constant source of danger to the whole system. In reference to their treatment Butlin[2] says: "I am strongly in favor of removing every tuberculous ulcer of the tongue which appears to be primary while it is still of

[1] *Loc. cit.* [2] *Loc. cit.*

small size and easily within reach of operation, as it may preserve the patient from further tuberculous disease by infection through the ulcer. The operation is not formidable, and will probably save the patient a great deal of distress. I am prepared to go even farther, and to remove a secondary tuberculous ulcer if it is limited and small, if the associated disease is not advanced, and if the operation is likely to be well borne; and I would urge the operation, not with a view to cure, or even to greatly prolong life, but in the hope of saving much distress." He strongly advises excision in preference to the cautery. Should, however, an operation be refused or deferred, it is necessary to fall back on local treatment. This should be unirritating; caustics are to be avoided. Most relief is to be obtained by demulcent or weak alkaline lotions:

℞. Sodii bicarbonat., gr. x;
Acidi carbolici, gtt. ij;
Aquæ, q. s. ad f℥j.—M.

Or,

℞. Sodii bicarbonat., gr. xj;
Thymol., gr. j;
Aquæ, q. s. ad f℥iv.—M.

Or,

℞. Acidi boric., gr. x–xv;
Aquæ, q. s. ad f℥j.—M.

Iodoform in powder may be dusted over the surface in the following manner: The surface of the ulcer is to be thoroughly cleansed with a stream of warm water, containing potassium permanganate (2 grains to the ounce) or boric acid (10 grains to the ounce); then thoroughly dried with absorbent cotton and dusted thickly with the following powder:

℞. Pulv. iodoformi, gr. j;
Morphinæ sulph., gr. $\frac{1}{6}$;
Acidi boric., gr. iij.—M.

This may be repeated two or three times a day. If thought better, aristol instead of the iodoform may be used with morphine. Dr. Steward has found Schwimmer's formula of papayotin of much service when the iodoform application had failed:

℞. Papayotin., ʒij;
Glycerini,
Aquæ, āā. f℥j.—M.
Sig. Apply five or six times daily.

Lactic acid is also of service. The method of using this in Joseph's clinic in Berlin is as follows: It should be well brushed over the surface of the ulcer with a stiff brush until bleeding is produced, beginning with a 30 per cent. solution in glycerin. If very painful, a previous application of cocaine may be made. A gargle of precipitated chalk is subsequently to be used by the patient. The application is to be repeated every four or five days, and the solution of lactic acid is gradually increased to 50 per cent. Afterward, when showing signs of healing, some gentle astringent may be used or the surface may be dusted with a powder containing equal parts of aristol and bismuth subnitrate.

If we have to deal with tubercle in a syphilitic subject, Schoek agrees with Neelopil that at the beginning of the disease an antisyphilitic treatment may be of decided utility, but later on, when the ulcers take on more of a tuberculous character, it is quite useless. If pain and salivation are very great, it may be advisable to divide the lingual nerve. While carefully using these local applications, all proper constitutional remedies must be employed against the disease. The diet, while very nourishing, should be soft, to avoid painful movements of the tongue.

Carcinoma.

In carcinoma little can be done by medicine except to palliate, but there are cases in which patients refuse an operation or in which the disease recurs, and the physician will be required to effect some alleviation of the suffering. The principal indication is to relieve pain. Our main reliance must be on the insufflation of a powder containing either iodoform and morphine or aristol and morphine. The powder should be applied with, as far as possible, the same precautions as were directed to be used in the tuberculous ulcer, and should if possible be blown on the precise spot where the pain is most acute. In the amount of morphine to be used the physician must be guided by the circumstances. For the fetor the mouth may be washed either with a solution of peroxide of hydrogen or with a solution of potassium permanganate or with creasote-water, or the vapor of creasote may be inhaled. The following is Mackenzie's formula:

℞. Creasoti, ♏lxxx;
Magnesii carbon. levis., gr. xxx;
Aquæ, q. s. ad f℥j.—M.
Sig. One tea-spoonful to be added to a pint of water at the temperature of 160° F.

In feeding the patient, as every movement of the tongue may give

intense pain, the food must be soft, or, if finely minced, may be swallowed with a mouthful of fluid. It is well to commence early with enemata of prodigested nutriment. If hæmorrhage ensue, lint may be soaked in a little Monsel's solution and applied with gentle pressure after blood-clots are, as far as possible, removed. If this is not practicable, a tea-spoonful of the following solution may be slowly sipped, retaining it as long as possible in contact with the bleeding surface:

R.	Pulv. acidi tannic.,	gr. ʒvj;
	Pulv. acidi gallic.,	gr. ʒij;
	Aquæ,	q. s. ad f℥j.—M.

Tincture of hamamelis may also be given internally, 15 to 20 drops every three hours, and applied locally as a gargle with water—1 drachm to the ounce.

ACUTE AND CHRONIC GASTRIC CATARRH, GASTRIC ATROPHY, GASTRIC ULCER, GASTRIC CANCER, AND GASTRIC DILATATION.

By D. D. STEWART, M. D.

General Considerations.

The degree of success encountered in the diagnosis and in the subsequent management of the several affections with which it is the writer's province to deal depends so largely upon a general knowledge of the physiology of gastric digestion, as well as upon the correct employment of modern chemical manipulative methods, that a résumé of these must form a not unimportant part of this article.

Until very recent years gastric affections have been dealt with empirically only: formerly we could but conjecture as to the secretory, motor, and absorptive efficiency of the stomach, and our conjectures, based on no definite pathognomonic symptomatology, were often fallacious and led to harmful medication. Thus cases of fermentative hyperacidity were not infrequently regarded as those of pyrosis hydrochlorica, and we were wont to treat digestive disorders with pepsin and acid, whether accompanied by an increase or diminution in the gastric secretion. It was not unlike the practice formerly in vogue of diagnosticating Bright's disease, and routinely prescribing Basham's mixture in all instances in which albumin was discovered in the urine, irrespective of the underlying cause. But as the microscope and more comprehensive chemical tests in cases of albuminuria permitted the differentiation of functional from organic kidney affections, and gave a more correct insight into the character of the underlying morbid processes, so the more modern employment of the stomach-tube for purposes of diagnosis has effected a complete change in our methods of separating gastric affections, removing them from the uncertain ground of empiricism and placing them and gastro-therapeutics on a new and rational basis.

The form of tube best adapted for use both for removing a portion of the stomach-contents for diagnostic purposes and for lavage is that of soft black rubber, open at the tip, with one or more small oval

"velvet-eyed" fenestra in the walls immediately beyond its extremity. While it is desirable that these fenestra be of moderate size, they must not be large enough to render the tip of the tube so pliable that it will bend upon itself during introduction. This form of tube of soft rubber, open at the tip, with a fenestrum or two in its lateral wall, is that now in general use both in this country and abroad, it having entirely superseded the stiff rubber sound, which, though easier of introduction in the first portion of its passage in subjects who are unable to co-operate with the physician through lack of intelligence or excessive faucial irritability, possesses several decided disadvantages which have caused it to be abandoned in favor of the more flexible sound. A tube of red rubber is sold in the shops with both open and closed tip, the open tip having a bevelled edge and "velvet eye," as have the fenestra. As it is a trifle less flexible than the black tube, it can therefore be more readily introduced: while it is often necessary for the patient to swallow several times to ensure the entrance of the latter to the stomach, the former may be pushed onward by the operator without this. Unlike the stiff sound applied with the stomach-pump, its use is practically without danger in diseased conditions of the stomach, and it may therefore be employed where the other cannot be readily introduced. A closed-tip tube with eyes in the lateral walls is preferred by some, who believe it is less likely to become obstructed than that with the open tip. The writer has used both forms, and finds that one is about as satisfactory as the other. Tubes of varying length and size are to be had in the shops. Many consist of two portions, the gastric extremity joined to the other at a distance of about three feet by a piece of stout glass tubing. If these are of red rubber, the distal extremity is usually made a trifle more flexible than the gastric, and has joined to it a hard-rubber funnel of about 6 ounces capacity. One form of black rubber tube above mentioned has a length of about 5½ feet—much longer than is necessary except for lavage. It has an expanded extremity through which liquids may be introduced without the necessity of attaching a separate funnel, and for that reason is very convenient.[1] The writer now uses largely tubes of this sort of a diameter of one-third of an inch for lavage, as well as to siphon the contents of the stomach for diagnostic purposes; but on purchasing separates them at a distance of one metre from the stomach end, this length being ample for withdrawal of the stomach-contents in all cases. For lavage he joins the ends by means of a short piece of strong glass tubing, and thus uses the entire length of tube. The

[1] These tubes have at a distance of about 40 cm. a narrow band about them as an indication of the depth which the tube should enter in cases in which no or slight dilatation exists. This, though of service as a guide, often has to be disregarded, depending upon the level at which the outflow occurs with most readiness.

interposition of the glass tube has obvious advantages in lavage, besides that by it one can thus use the same tube both for diagnostic and therapeutic purposes. For lavage it is desirable that the tube after introduction should be sufficiently long to reach several feet below the level of the stomach, that ready siphonage be obtained, as will be explained on another page. For removal of some of the stomach-contents it is merely necessary that the distal extremity of the tube should be a few inches below the stomach level.

Preceding the introduction of the tube until the patient becomes more or less habituated to its use, it is a good plan in sensitive subjects to render the pharyngeal wall, especially the right half, moderately insensitive by means of cocaine. This may be applied in solution with a brush, by atomization, or, as the writer prefers, through a medicine-dropper, using a 2 or 3 per cent. solution, about a half drachm or more being deposited upon the right pharyngeal wall while the patient is sitting with mouth open and head thrown backward and inclined to the right side. The cocaine solution is retained for a few seconds in the pharynx, and then swallowed. This will render the pharynx, œsophagus, and stomach more tolerant, and will largely obviate retching, so common when the tube is used the first time or two. This tendency to retching in some cases not only renders the introduction of the tube very difficult, but it may, when very decided, entirely defeat our object—that of obtaining a sample of the usual gastric secretion. For where some little time is consumed in its introduction through the patient insisting on its being removed after it has engaged the œsophagus, the continuous retching may produce a reflux of bile from the duodenum into the stomach, and often, when retching has been pronounced during the introduction of the tube, and when more than the usual time has been consumed in inserting it, the writer has found the fluid withdrawn from the stomach very deeply stained with bile, and greater in quantity than it would have been had the tube passed readily.[1] The introduction of the tube is usually simply and rapidly done, provided the intelligent co-operation of the patient is obtained. He should sit erect, with head thrown back and mouth open. The tube is held in the right hand within a few inches of the gastric extremity, as one would hold a pen-holder; its first few inches having

[1] For this reason, when retching is easily induced by the use of the soft black tube, though cocaine has been resorted to in the manner described, it is better to employ the somewhat stiffer red tube already mentioned. This last possesses theoretically the disadvantages that, being a trifle less flexible, it may, by irritating the stomach-wall more than the softer tube, yield untrustworthy results in cases in which it is desired to remove a specimen of the gastric secretion in the fasting condition, and that in cases of ulcer may do damage to the latter. These objections are offset by the greater advantage that it can be introduced with more celerity and with less systemic disturbance.

been moistened with water,[1] it is guided over the root of the tongue to the pharynx, and beyond the epiglottis toward the œsophagus by the index finger of the left hand. Should it not promptly enter the œsophagus and pass the cardia, it must be rapidly pushed forward with the right hand, the patient being directed to swallow. Having once engaged the œsophagus, it can be pushed onward into the stomach with facility. The patient should be informed that he cannot by any possibility choke. If suffocation seems pending or should retching begin, he should be told to inspire deeply. Thus directed, the tube will at once enter the stomach. A slight gurgling is usually heard on the tube reaching the stomach, due to the passage of air into it from that viscus. There is no danger of the tube entering the trachea by mistake if ordinary care is exercised in introducing it. The operator, however, can readily assure himself that this has not occurred by compressing the tube and directing the patient to breathe, which would be impossible had the tube entered the larynx. While swallowing the tube is an easy matter with some persons after a trial or two, with others, especially nervous females, it is occasionally almost an impossibility by reason of the nausea, vomiting, and general distress attending its entrance into the pharynx, which may necessitate the abandonment of the procedure. Should brushing the throat with a strong (10 to 20 per cent.) solution of cocaine immediately before its introduction not prevent the occurrence of these symptoms, it is better not to persist in its trial, especially if gastric ulcer be suspected, as the violent retching and vomiting might induce hæmorrhage. A gargle of potassium bromide used several times daily for a short time preceding the introduction of the tube will assist materially in allaying nausea due to mere faucial irritability. The tube should not be used if hæmatemesis has recently occurred or if a thoracic aneurism is suspected. The presence of ulcer itself does not preclude the use of the soft tube.

In removing the tube care should be taken to compress it tightly before it has been withdrawn from the œsophagus, so that by no possibility can any of the contents pass into the larynx.

The stomach-contents are removed by epigastric pressure (method of Ewald and Boas) or by aspiration: the former is effected by causing the patient to make forcible voluntary contraction of the abdominal muscles, steady pressure being applied to the epigastrium; the latter, by attaching to the extremity of the tube below the level of the stomach some form of suction apparatus, such as a small syringe or a more elaborate aspirator. The writer has not found the expression method so

[1] Moistening the tube is not actually essential, there being sufficient mucus in the pharynx to lubricate it; if desired, however, the gastric extremity may be first dipped in water. Oil, glycerin, or milk is unnecessary, and should not be used when the tube is introduced for diagnostic purposes.

uniformly successful as that by aspiration, which he now invariably practises in the following manner: He attaches to the extremity of the tube, which should be of sufficient length to reach below the level of the stomach, a wide-mouthed 8-ounce bottle with a rubber stopper containing two perforations in which glass tubes are inserted, one reaching quite to the bottom, the other extending about an inch below the level of the stopper; the outer extremity of each is bent at a right angle.[1] The stomach-tube is attached to the outer extremity of the longer glass tube, and a hand-bulb syringe, minus its metal or hard-rubber extremities, to the other, in such a way that a sufficient exhaust of the bottle can be readily accomplished. This is done after the tube has been inserted and its outer extremity brought with the bottle below the level of the stomach. A vacuum being created and maintained in the bottle in this position, the contents of the stomach pass through the tube into it. Should doubt exist as to the stomach being full, and no flow occur after the tube is inserted to the depth at which prior physical examination has shown is the lower level of that viscus, it should be passed farther into the stomach and then gradually withdrawn, the glass tube being carefully watched to note the onset of the flow; if none occurs, it is probable that the fenestra are obstructed. A bulbful or so of air should be pumped through the tube, either by reversing the syringe on the bottle or by attaching it directly to the stomach-tube. If, following this aspiration, nothing is obtained, a small measured quantity of tepid water may be thrown into the stomach and at once aspirated off. Food-elements if present will probably return with it. The time occupied in the evacuation of the stomach should be as brief as possible, both for the sake of the patient's comfort and to avoid errors likely to arise through the local stimulating effects of the tube on the gastric mucous membrane.

Various methods have been proposed by which the condition of gastric secretion could be arrived at without a resort to the tube. The most practicable of these seems that of Einhorn's. Einhorn[2] has devised an apparatus which he styles a stomach-bucket,[3] consisting of a small oval silver vessel ($1\frac{3}{4}$ cm. long, $\frac{3}{4}$ cm. wide), on the top of which is a large opening with an arch over it. To the latter a stout and long

[1] This is an ordinary inhaling-bottle, such as is sold by oxygen-dealers; a similar appliance can be easily made, using a bottle of any desired capacity. This possesses an advantage over the syringe or the valveless bulb attached to some stomach-tubes, that aspiration can be more surely effected and with the same freedom from injury to the gastric mucous membrane. The bottle stopped by an ordinary cork serves to transport the removed contents to the laboratory should the operation have been done away from it.

[2] *Medical Record*, N. Y., May 19, 1890.

[3] This is manufactured by Messrs. John Reynders & Co. of New York City.

silk thread is tied, and at the distance of 40 cm. from the bucket a knot is made in the thread. The vessel is placed on the root of the patient's tongue, and he is told to swallow once. In a half minute or so the bucket reaches the stomach, of which we are certain by the knot coming into the mouth. After remaining in the stomach about five minutes it is withdrawn. In its removal resistance felt at the introitus œsophagi is overcome by having the patient expire deeply or swallow once. This method is very ingenious, and, according to Dr. Einhorn, very successful. He suggests that by it can be determined also the permeability of the œsophagus, the distance of the cardia from the teeth, its patulousness, and, partly, the condition of the gastric peristole, by noting the force with which the thread is pulled farther in. The method should be of more utility in cases of suspected ulcer, when the occurrence of hæmatemesis renders the use of the tube inadvisable. Mucus may be prevented from filling the bucket above the stomach by closing its opening before its ingestion with a thin gelatinous capsule. The vessel may require to be reintroduced several times if a negative response occurs to tests for free hydrochloric acid. Should there be no response, it would be preferable to remove the contents of the stomach through the tube in the usual way.

The functions of the stomach that necessitate investigation in order to establish a proper basis for the application of rational therapeutic measures are the secretory, motor, and absorbent. So intimately related are these that a disturbance in one is soon succeeded by a like departure from the normal in the others.

The secretory function involves the elaboration by certain portions of the glandular apparatus of the mucous membrane of pepsin-hydrochloric acid and a milk-curdling ferment.[1]

The principal office of the former is the solution and more or less complete digestion of albuminoids. The latter is accomplished by a process of hydration perhaps similar in type to the transformation of starch by diastase. The chief end-product of the digestion of albuminoids is peptone, yet, as the researches of Kühne, Chittenden,[2] and others have shown, but a minimum amount of true peptone seems to result even through the long-continued action of pepsin-hydrochloric acid digestion. Between the albuminoids and the final product of their digestion, true soluble peptone, there are a number of intermediate

[1] Though HCl will coagulate milk by uniting with the alkali of the casein, which keeps the latter in solution, and will thus cause its precipitation, the milk-clotting ferment of the gastric juice is quite distinct from either pepsin or HCl. The researches of Johnson, Boas, and Klemperer indicate that it is first elaborated as a zymogen, which is transformed into the milk-curdling ferment by the action of HCl and also by the organic acid. (*Vide* v. Jaksch, *Clinical Diag.*, p. 95, London, 1890.)

[2] "On the Relative Formation of Proteoses and Peptones in Gastric Digestion," *Journal of Physiology*, vol. xii. No. 1, 1891, p. 12.

substances, some of which until recently were regarded as identical with peptone.

The first issue of the gastric digestion of albuminoids is probably syntonin or acid albumin, a compound of hydrochloric acid and albumin. This is subsequently converted into the albumoses (or proteoses),[1] and some of these finally into the ultimate product of peptic digestion-peptones. For the proper solution and transformation of proteids into proteoses and peptones, to fit the latter for absorption, and that portion of the former which possesses a low diffusibility for tryptic conversion into the more soluble peptones, a definite secretion of pepsin and acid is necessary.

Pepsin,[2] which is formed in the chief cells of the tubules, principally those of the cardia, is not found in these except as a pro-enzime, pepsinogen or propepsin. It exists as the latter in the granules of the cell, and undergoes conversion into pepsin through the action of hydrochloric acid (or sodium chloride).

Pepsin is a hydrolytic ferment which can display activity only in the presence of an acid.[3]

The rapidity of digestion is directly proportionate to the amount of pepsin (within limits) in the digestive mixture. Pepsin possesses, like the other digestive ferments, extraordinary continuous activity. Very little is consumed in the digestive process. With the acid maintained in uniform amount, fresh albuminoids are attacked and dissolved when those previously acted upon are disposed of.

The most vigorous proteolytic action takes place with hydrochloric acid in the proportion of from 0.1 to 0.2 per cent. Unlike the case with pepsin, the acidity, though varying[4] considerably during

[1] The latter, which formerly were regarded as a single body, propeptone, have been shown by Kühne and Chittenden to consist of at least three substances, proto-, hetero-, and deutero-albumose, each of which, in the order named, progressively approaches peptone, and may be distinguished from the other by appropriate tests. (Kühne and Chittenden, *Zeitschrift für Biologie*, Bd. xix. 159, 1883; xx. ii. 1884; and xxii. 409, 1886; Kühne, *Verhandl. des Naturhistor. Medic. Vereines zu Heidelberg*, No. 1, iii. p. 286; and Chittenden, *Journal of Physiology*, vol. xii. No. 1, 1889, p. 12.)

[2] Acetic and lactic acids also possess the power of converting propepsin into pepsin and lab-zymogen into lab-ferment; so that if HCl be wholly absent these ferments may be found. (See Johannessen, "Studien über die Ferments des Magens," *Zeitschrift f. klin. Med.*, Bd. xvii. 1890.)

[3] Though HCl is the acid of the gastric juice and is essential for vigorous digestion, proteolytic action will go on without HCl in presence of other acids. Chittenden (*Med. News*, Feb. 16, 1889, "Observations on Digestive Ferments") found proteolysis active in presence of a 0.6 to 2 per cent. oxalic acid, 0.2 per cent. nitric acid, and 0.3 per cent. sulphuric acid. With the above percentage of nitric acid four-fifths as much proteids were dissolved as in presence of 0.1 per cent. HCl. Lactic acid possesses only one-sixth to one-third the power of HCl, while acetic and butyric acids he found have no digestive action.

[4] Chittenden found by quantitative trial that by using a pepsin of moderate strength and blood-fibrin as the proteid, the most vigorous digestive activity took place in the

digestion, displays a tendency to maintain a certain fixed average. Should this be increased or diminished by the addition of acid or alkali, the mean is restored automatically, either by cessation in or an increase of secretion;[1] but, though free hydrochloric acid is usually present in the gastric juice to the extent of 0.15 to 0.2 per cent.—and vigorous proteolytic action is impossible without it—only at a certain stage of digestion is it found to approach this amount, while during a portion of the digestive period it seems to exist only in combination with other substances, and the time of its appearance as free acid after food depends on the amount and character of the aliment ingested.[2]

Thus, after a light meal consisting of a few pieces of bread or a roll and water or weak tea,[3] the reaction for free hydrochloric acid is usually obtained in from half an hour to forty-five minutes, while that for lactic acid and acid phosphate appears within ten to fifteen minutes. Lactic acid continues to be present for nearly an hour, until free hydrochloric acid appears in appreciable quantities, after which hydrochloric acid is the only free acid present. After a more generous and varied meal[4] free hydrochloric acid is not recognizable until within four or five hours, and the lactic-acid period of digestion persists from the onset of the digestive act for two hours or longer.

The digestive period may therefore be divided into two stages, the duration of each of which is variable, depending upon the amount and character of the food taken. During the first, which usually

presence of 0.1 per cent. free HCl. ("Observations on the Digestive Ferments," *The Medical News*, Feb. 16, 1889.) Roberts (*Diet and Digestion*) noticed no difference in result between any proportion of acid varying from 0.1 to 0.3 per cent. HCl. But, as stated by Chittenden (*ibid.*), the strength of acid best fitted for digestion depends somewhat upon the amount of ferment present and the character of the proteids to be digested.

[1] Richet, *Du Suc gastrique*, Paris, 1878.

[2] Secretion of HCl occurs immediately on the entrance of the ingesta into the stomach, but the non-appearance of it as free acid for a more or less considerable time after eating depends upon the fact that HCl, like other mineral acids, has the power to decompose salts of the organic acids, which, present as lactates, neutral or basic phosphates, unite with HCl, forming a chloride of their base, liberating the organic acid. This sodium lactate or neutral potassium phosphate in the presence of HCl would result in the formation, in the first instance, of sodium chloride and lactic acid, and in the second of potassium chloride and acid sodium phosphate. In addition to this, the free HCl unites with other organic bases and nitrogenous compounds having basic properties, and especially with the albuminoids, so that it is not until material for further chemical combination with HCl is exhausted and saturation of albuminoids is complete that response occurs to tests for free HCl, and the average percentage necessary for healthy digestion is maintained. (Ewald, *Klinik der Verdauungskrankheiten*, vol. ii., 1888; Leo, *Diagnostik der Krankheiten der Verdauungsorgane*, 1890.)

[3] This is substantially Ewald's test-breakfast, which consists of 35 to 70 grammes of white bread and 300 cem. of water, or a cup of weak tea without milk or sugar. (Ewald, *loc. cit.*)

[4] Such as Leube's or Riegel's, consisting of 400 cem. of beef-soup, 200 grammes of beefsteak, 50 grammes of white bread, and 200 cem. of water.

occupies from fifteen minutes to half an hour or more, the acidity of the gastric contents is feeble, and is due to lactic acid; free hydrochloric acid is not present. It is during this stage that the further saccharification of starch, which, initiated in the mouth, occurs, and continues so long as the acidity remains low and is not due to free hydrochloric acid. So soon, however, as the latter equals a few thousandths of 1 per cent., destruction of the ptyalin occurs, and starch digestion, which had begun to be inhibited as complete saturation of the proteids by hydrochloric acid took place, ceases.[1] The second stage is characterized by the complete saturation of the albuminoids by hydrochloric acid and their gradual transformation into peptones, and the presence of free hydrochloric acid in the stomach, which continues to increase until the normal limit is reached, while lactic acid diminishes or entirely disappears.

Besides the necessity for a proper secretion of hydrochloric acid as a synergist to pepsin, it has another important function which may be mentioned, and which, indeed, is regarded by some[2] as the chief—that of maintaining the ingesta in a condition of asepticity. Lactic, acetic, and butyric acids are unlikely to develop, except, of course, when already present in the ingesta as salts, when free hydrochloric acid exists in the stomach-contents. A portion of the lactic acid present in the early period of digestion probably arises from fermentation of carbohydrates through the action of the bacilli aceti lactici, which action ceases later in the presence of a small amount of free hydrochloric acid. Moreover, pathognomonic micro-organisms, such as the bacilli of enteric fever and of cholera, which may be accidentally ingested with the food, are destroyed by this acid.[3]

Normally, during fasting secretion of gastric juice probably does not occur, unless it be excited reflexly through the senses by food during hunger.[4] Examination of the secretory functions in the fasting condition has, however, given rise to some divergent results. Most observers—among which may be mentioned Riegel,[5] Ewald,[6] Jaworski,[7]

[1] Chittenden, *Med. News*, Feb. 16, 1889.

[2] G. Bunge, *Lehrbuch der Physiolog. u. Patholog. Chem.*, quoted by L. Wolff, *Med. News*, Sept. 21, 1889.

[3] Leo, *loc. cit.*

[4] Even then it may be induced in another way than by direct excitation—through swallowed saliva; for, though there is no afferent nerve the stimulation of which causes a secretion of gastric juice, there seems no doubt that secretion may be brought about through some indirect nervous channel. Thus, Richet (*loc. cit.*) noted in a case of complete occlusion of the œsophagus, in which a gastric fistula had been made for the purpose of nourishment, that sugar or lemon-juice placed in the mouth caused gastric secretion, as did also the mere smell or sight of food.

[5] *Zeitschr. f. klin. Med.*, Bd. xi. p. 11.

[6] *Loc cit.*

[7] *Wiener med. Woch.*, 1886, No. 49.

Leube,[1] Kinnicut,[2] and others—as a result of numerous examinations conclude that this function is latent during fasting, while Rosin,[3] Schreiber,[4] and others believe that even in fasting conditions a continuous secretion takes place. Thus from 44 patients examined while fasting Rosin[5] failed to obtain fluids in but 2; in 11 the fluid contained no free hydrochloric acid, while in the remaining 31 free hydrochloric acid and pepsin were found; and Schreiber, who has obtained through the expression method upward of 60 cem. of good digestive secretion during fasting, believes that it is possible with this method always to withdraw some gastric fluid. Others, such as Pick,[6] have reported similar results, but think it likely that irritation of the gastric mucous membrane by the tube induces the secretion removed, as do also Ewald and Boas. As the mere presence of food in the mouth will produce a flow of gastric juice, which may be caused by the saliva swallowed as well as reflexly, it is not unlikely that the gastric secretions obtained during fasting, and indeed a portion of that which is withdrawn when the tube is introduced some time after a test-meal, is caused by the irritation of the tube in the mouth and pharynx, inducing a free outpouring of saliva,[7] some of which, ingested, directly stimulates an outflow of gastric juice, and perhaps reflexly through the tube in the mouth acting as did sugar and lemon-juice in Richet's case. Certainly, there can be no doubt that mere local mechanical stimulation of the gastric mucous membrane by a foreign body will induce gastric secretion.[8]

Beaumont's observations on Alexis St. Martin demonstrated this, and similar experiments have been repeated on animals with like effect. As the result of a large number of experiments on St. Martin with a view to determine the secretory condition of the stomach during fasting, Beaumont[9] almost invariably found that the stomach contained no gastric juice when aliment was not present, but that any digestible or irritating substance when applied to the internal coat excited the action of the gastric vessels, producing an outflow of fluid. On the introduction of a gum-

[1] *Deutsches Arch. f. klin. Med.*, Bd. 33, p. 3.

[2] *Med. Record*, N. Y., May 24, 1890.

[3] *Deutsche med. Wochen.*, 1888, No. 47, p. 996.

[4] *Archiv für Experiment. Pathol. und Pharmacologie*, Bd. xxiv. p. 365.

[5] *Loc. cit.*

[6] *Prager med. Woch.*, 1889, No. 18; and also Rosin, *Deutsch. med. Woch.*, 1888, No. 47; and Hoffmann, *Berl. klin. Woch.*, 1889, No. 12.

[7] The introduction of the tube until the patient becomes habituated to its use nearly always leads to free salivary secretion, much of which is involuntarily swallowed.

[8] It has been found by Blondlot and Bernard that when the gastric mucous membrane is gently tickled it becomes very rosy and secretes gastric juice freely. (Brunton *On Disorders of Digestion*, p. 172.)

[9] *Experiments and Observations on the Gastric Juice*, 1833, pp. 105, 121, 128, 135, 137, 217.

elastic tube the size of a goose-quill through the fistula into the clean fasting stomach, and placing St. Martin in such a position that the gastric orifice was dependent, a flow of juice was soon induced. It at first appeared tardily in drops, then in an interrupted, and sometimes in a short, continuous stream. Moving the tube about increased the discharge. The amount ordinarily obtained in this manner during the fasting condition varied from ½ to 2 fluidounces, and ten to fifteen minutes were necessary to collect even this small quantity. On some occasions a small quantity of mucus only could be obtained. The juice digested albuminous foods when brought into contact with them outside of the body.

Mode of Examination of the Gastric Secretions.

If it is desired to ascertain whether the secretory function is active during fasting, the stomach should be washed out on the preceding night and the tube introduced in the morning. If the amount withdrawn be upward of 50 cc.,[1] and show the presence of pepsin and hydrochloric acid, a condition of hypersecretion probably exists which, as a rule, is accompanied by a decided increase in the percentage of free hydrochloric acid normally secreted. This condition has been termed by Jaworski *gastrorrhœa acidi simplex*, and exists alone or in combination with some of the neuroses, such as melancholia or hysteria, and is now regarded as a probable cause of gastric ulcer. It also more rarely occurs with chronic gastric catarrh. When the stomach has not been washed out on the preceding night, and food-masses are removed during the fasting condition, atony of the stomach, present in acute and chronic catarrh and in gastric dilatation, is indicated. Sarcinæ, saccharomyces, and other evidences of decomposition are then present.[2]

To ascertain the secretory condition of the stomach, the gastric contents are best examined after a trial-meal. The food should be ingested, therefore, on an empty stomach, preferably in the morning, and should always be of the same quantity and character.[3] A number of examinations are usually necessary, repeated under similar conditions, before an opinion can with certainty be formed as to the secretory function of the stomach. Several varieties of test-meals are recommended: those apt to furnish the most satisfactory results are Ewald's breakfast and Leube's and Riegel's dinner.[4] The former, which is a convenient modification of

[1] Kinnicut (*loc. cit.*) states that as the question of the condition of the fasting stomach is still *sub judice*, in order to avoid any possible error he places a limit of 50 cc. of gastric juice as a basis of diagnosis of hypersecretion. Jaworski (*Wiener med. Wochenschr.*, Nos. 49–52, 1886) regards all cases as those of hypersecretion in which more than 10 cc. can be removed from the fasting stomach.

[2] Leo, *loc. cit.*, p. 84.

[3] For the reason already stated, that the time of appearance of HCl depends upon the nature of the food taken.

[4] The composition of these meals is given on a preceding page.

Riegel's and Leube's test-dinner, is usually to be preferred, since its ingestion and subsequent removal are easy. While Leube's and Riegel's trial-dinner induces a freer secretion of gastric juice, it is less readily eaten, and has the additional disadvantage that in its removal particles of undigested food sometimes clog the fenestra of the tube. The stomach-contents are evacuated one hour after the test-breakfast and between the fourth and fifth hours after the trial-dinner, these intervals corresponding to the height of digestion after the meal, at which time secretion of free hydrochloric acid and pepsin should be normally at their maximum and by-products of decomposition least appreciable. On removal of the gastric contents its general appearance is noted; blood, bile, masses of mucus, and undigested food are looked for. It is then filtered into a dry beaker, and the filtrate examined qualitatively, and, if necessary, quantitatively, for free hydrochloric acid especially, and perhaps also for pepsin, rennet-ferment, albuminoids, carbohydrates, and the products of digestion—peptones and albumoses; also for phosphates, lactic acid, and the occasional fatty acids, such as acetic, butyric, valerianic, which latter are found in pathological conditions only.

A qualitative examination for free hydrochloric acid, and, *a fortiori*, for the organic acids, is indeed often all that is necessary; a rough quantitative estimate, sufficient for practical diagnostic purposes, may be made by noting the mode of response to qualitative tests. Thus, when Günzberg's reagent gives a decided rosy-red reaction with but little concentration of the gastric filtrate, it may be concluded that free hydrochloric acid is normal in amount or in excess; while, on the contrary, should but a faint or fleeting red be shown by considerable concentration of the filtrate, or should no response at all occur with Günzberg's test, yet the calcium-carbonate test show free hydrochloric acid, subacidity is indicated. Cancer and gastric atrophy may be excluded in the first instance (having in mind those exceptional cases of cancer in which hydrochloric acid is in excess) and ulcer in the latter; cases of gastric catarrh, if characterized by hyperacidity, may be differentiated, and the indications for the employment of hydrochloric acid made clear. Whatever form of examination be undertaken, it is better to precede it by a quantitative estimate of the total acidity of the gastric contents, since by it inference as to several important points may be drawn with some degree of accuracy. Thus, should the total acidity be more than 70 and the ferric-chloride color-test for lactic acid and the other tests for fatty acids indicate but a minimum of the former and little or none of the latter, the excess of acidity is evidently due to hydrochloric acid if excess of acid phosphates can be excluded.

The following method will be found convenient in the chemical

examination of the gastric contents. It is that which the writer generally pursues:

1. After filtration the reaction of the filtrate is determined.

2. A known portion, say 10 cc., is used for the estimation of total acidity.

3. A small quantity of the filtrate is tested for free acid and acid salts.

4. One or more of the qualitative tests for free hydrochloric acid are applied, preferably Günzberg's, Boas's resorcin, or the calcium-carbonate tests, following which.

5. Tests for lactic and the occasional fatty acids are made; and, subsequently, if necessary, a quantitative estimate of free hydrochloric acid and the organic acids is determined by Leo's method.

If necessary also the filtrate may be examined for pepsin and rennet, ferments, for albumoses and peptones, and finally for carbohydrates.

The reaction may be determined by litmus-paper or congo-paper or by an alcoholic solution of phenolphthalein.[1]

The absolute acidity, which is expressed by a number representing the number of cubic centimetres of test-solution required exactly to neutralize 100 cem. of gastric filtrate, is determined by titration with a decinormal solution of sodium hydrate.[2] Ten cem. of stomach-filtrate are placed in a clean dry porcelain or glass dish, and a few drops of phenolphthalein solution added as the most delicate indicator of beginning alkalinity. Air is first thoroughly carried through the filtrate to remove any dissolved carbonic dioxide frequently contained in the stomach-contents, and the sodium solution slowly dropped, with constant stirring, from a burette graduated to tenths of centimetres, until the liquid assumes a persistent very faint red hue. The quantity of the decinormal sodium solution used in cubic centimetres and fractions thereof is now noted; and from this the total acidity estimated by multiplying the number of cubic centimetres of sodium solution consumed by the number of times the cubic centimetres of filtrate actually used for neutralization are contained in one hundred. Thus, if 5 cubic centimetres of filtrate are taken, the number of cubic centimetres of sodium solution is multiplied by 20; if 10, by 10; if 20, by 5. One hour after Ewald's test-breakfast the total acidity should be between 20 and 60.[3] These figures indicate an acidity which if due to hydrochloric acid alone would represent 0.07 and 0.21 of that

[1] This last remains colorless in a neutral or acid medium, but develops a bright carmine hue in alkaline solutions.

[2] Four grammes of NaHO dissolved in one litre of distilled water is used for neutralization; each cem. of this solution will exactly neutralize .00364 grammes of absolute hydrochloric acid. The number of cem. so used multiplied by .00364 equals the percentage of HCl contained in 100 cem. of the gastric filtrate.

[3] Leo, *loc. cit.*, p. 117. Ewald gives as the normal 40 to 65 (*loc. cit.*, p. 23).

acid. Values constantly below 20 (2 ccm. NaHO solution) would show subacidity, or constantly at or above 70 (7 ccm. NaHO solution), hyperacidity.[1]

The special significance of hyperacidity depends upon whether it arises from the presence of organic acids and acid salts or through hypersecretion of hydrochloric acid. Hyperacidity due to organic acids is of relatively frequent occurrence. It arises from abnormal decomposition of ingesta in the stomach, and is common in gastrectasia, acute and chronic gastric catarrh.

Examination for Free Acids and Acid Salts.—Since an acid reaction of the gastric contents may be due either to free acids or acid phosphates, or to both, Leo's[2] calcium-carbonate test, which permits the ready distinguishing of one from the other, is of great value. It is based on the fact that calcium carbonate in cold solution will neutralize free acids, so that an acid reaction is no longer obtainable, while it is without influence on acid phosphates, which still respond to tests for acids, reddening litmus as before. A small quantity of the stomach-filtrate is thoroughly mixed in a watch-glass with a little dry, *chemically pure* $CaCo_3$. The reaction is then taken with blue litmus-paper and compared with that of the original. Should the solution now not redden blue litmus, acid salts are absent. If the paper is reddened less intensely than at first, both acid salts and free acids are present. If the acid reaction is not markedly altered, free acids are much diminished or absent.

Leo states that by this method as small a percentage as 0.002 of free hydrochloric acid and 0.01 of lactic acid can be shown with certainty, but if a decided amount of acid phosphates is present the exactness of the test may be somewhat lessened; but even then 0.008 per cent of hydrochloric acid can be detected. After the organic acids are removed it proves the most delicate and certain test for free hydrochloric acid, as will be explained on another page.

Reagents that Respond only to Free Hydrochloric Acid.—There are two tests (Günzberg's phloroglucin-vanillin and Boas's resorcin) that respond only to free hydrochloric acid concerning the positive results of which there can be no ambiguity. They are, for this reason, decidedly preferable to the congo-red, methyl-violet, benzo-purpurine, tropaolin, and other color reagents which react more or less to organic acids, and which cannot be regarded as positive tests for the presence of hydrochloric acid unless restrictions of various sorts are practised.

Günzberg's test consists of 2 gm. phloroglucin, 1 gm. vanillin, and 30 gm. of absolute alcohol, and is applied as follows: An

[1] Leo, *loc. cit.*, p. 117.

[2] *Loc. cit.*, p. 91; and *Centrabl. f. d. med. Wissench.*, No. 26, 1889.

equal amount—one or more drops—of the stomach-filtrate and of the foregoing solution are placed together in a white porcelain dish and gently heated over a small flame, in such a way as to hold a thin layer at the bottom of the dish, avoiding scorching. After slight evaporation a delicate rose-red tinge appears at the margin of the liquid, which becomes an intense cherry-red, depositing crystals of a similar color in the presence of a decided amount of free hydrochloric acid. If but a small quantity of free hydrochloric acid is present, some condensation of the gastric filtrate may be necessary. To avoid the employment of too great heat, which might result in the development of a brown color through combustion of organic substances, and thus interfere with the delicacy of the response, evaporation on a water-bath is preferable. If but a trace of free hydrochloric acid is present, to which the test responds, the distinct red color which appears at the edge as evaporation progresses may be of only momentary duration. An approximate determination of the amount of free hydrochloric acid may be made by the test in the manner described, or preferably after the method of Günzberg, who ascertained that a drop of the normal stomach-contents could be diluted upward of ten times, and the reaction still be faintly obtained.[1] Inability to obtain a response with less dilution or with none, or even with concentration of the undiluted contents, would of course indicate sub- or anacidity, while the reaction occurring with over twelve dilutions would point to hyperacidity.[2] Boas's[3] solution consists of resublimed resorcin gm. 5, sugar gm. 3, dilute alcohol gm. 100. Its method of application is similar to that of Günzberg's test: a few drops are heated in a porcelain dish with an equal quantity of the stomach-filtrate; from a rose to a vermilion hue shows the unquestionable presence of free hydrochloric acid. Both of these tests respond with nearly the same degree of delicacy to free hydrochloric acid; any slight difference exists in favor of the phloroglucin-vanillin solution. The latter is the one the writer almost habitually employs, but in the few instances in which he has resorted to the resorcin test the results have been equally satisfactory. The response of these two tests in the manner described is a positive indication of the presence of free hydrochloric acid. But, unfortunately, both tests are less valuable from a negative point of view.

For the detection of free hydrochloric acid in watery solutions these tests leave little to be desired on the score of delicacy, but, unluckily,

[1] *Centralbl. f. klin. Med.*, 1887, No. 40; Ewald, *loc. cit.*, p. 24; Leo, *loc. cit.*, p. 96.

[2] Dr. Max Einhorn, the deviser of the ingenious silver bucket for obtaining small amounts of the stomach-contents without resort to the tube, informs me that as a result of considerable investigation he concludes that normally the response cannot be obtained after eight dilutions. He has found by titration that eight dilutions equal pretty nearly the normal acidity (50 to 60).

[3] *Centralbl. f. klin. Med.*, Bd. ix. p. 817, and Leo, *loc. cit.*, p. 97.

the same conditions do not hold in the presence of some of the most common constituents of the gastric contents during digestion. Thus, in watery solutions .004 per cent. of hydrochloric acid may be detected by the Günzberg test, and .006 by Boas's resorcin test, while in the presence of certain compounds, such as 2 per cent. peptone solution, as much as 0.15 per cent. of free hydrochloric acid may not respond to either. Notwithstanding this, the reaction obtained with these tests affords undoubted evidence of the presence of free hydrochloric acid, and, being so easy of application, one or the other should always first be tried when a mere qualitative examination is made: a negative response resulting, hydrochloric acid cannot be pronounced absent until the $CaCo_3$ test also fails. The latter is the only one of the several tests the reaction of which is uninfluenced by the presence of other combinations in the stomach. Large amounts of acid phosphate alone interfere very slightly with its delicacy, it being then somewhat difficult to make an accurate comparison between litmus reddened by the presence of but a trace of free hydrochloric acid and decided amounts of acid phosphates, and that reddened by the phosphates alone. Despite this, as small a percentage of free hydrochloric acid as 0.008 may be detected by the $CaCo_3$ test in the presence of acid phosphates.[1]

The calcium-carbonate test is applied in the manner directed for ascertaining the presence of free acids and acid salts. Lactic acid having been removed by agitation with ether and the fatty acids by heat, a piece of blue litmus-paper is moistened with the solution, and the red tint produced compared with that obtained by moistening a second piece with the stomach-filtrate after neutralization of the free acid by dry C. P. calcium carbonate.[2]

Examination for Organic Acids.—Lactic acid may be detected by a modification of Uffelmann's carbolated ferric-chloride test.[3]

[1] Leo (*loc. cit.*, p. 98, *et seq.*), who has carefully investigated this subject, has shown that all color reagents for free hydrochloric acid are more or less influenced in delicacy of response by the presence of various substances occurring in the stomach during digestion—the ingesta and the products of their metamorphosis. This influence is unfortunately most marked with Günzberg's and the resorcin test, which in other respects are so superior. This interference is occasioned by a portion of the free HCl uniting with and suffering neutralization by the ingesta.

[2] The digestive test suggested by Leo (*loc. cit.*, p. 98) for the presence of free hydrochloric acid is scarcely practicable. It may, however, at lest be mentioned here. It is based upon the fact that free hydrochloric acid is necessary for pepsin digestion, at least in the absence of very large amounts of the organic acids. The presence of the latter being excluded and digestion of albuminoids proved, it may be accepted that the stomach still secretes hydrochloric aid. Leo recommends a test-meal consisting of a measured amount of albuminoids, such as a half litre of milk or two eggs, which is to be removed one hour after its ingestion and the amount of albumoses and peptone now contained in it compared with the same in the food before its ingestion.

[3] Uffelmann's original test for lactic acid of carbolated ferric-chloride is very unreliable, since it responds also to glucose and acid phosphates.

An aqueous solution of ferric chloride so dilute as to be almost colorless is placed in a test-tube and a few drops of the gastric filtrate added; the faint yellow color of the iron solution, while not affected by the addition of hydrochloric, butyric, or acetic acid, is intensified in presence of dilute lactic acid.[1] To avoid the possibility of error, Kinnicut[2] advises comparing the tube containing the tested filtrate with a second of the original iron solution. Thus used, the writer has found the test very satisfactory, though, according to Leo,[3] it, like the carbolated ferric-chloride test, reacts also to peptones and the lactates. To obviate all such sources of fallacy, Leo advises the removal of the fatty acids by heat,[4] the extraction of lactic acid by ether, and the testing of an aqueous solution of the ethereal extract by Uffelmann's reagent and with calcium carbonate (or congo-red solution).

The fatty acids which appear in certain gastric derangements, such as dilatation, acute gastric catarrh, and less often in chronic gastric catarrh and gastric atrophy, arise through decomposition of the ingesta, chiefly because of a deficient secretion of hydrochloric acid,[5] and may be readily detected in the following manner: A few ccm. of the gastric filtrate are heated in a test-tube, a piece of blue litmus-paper moistened in water being held over the mouth of the tube; as the fatty acids alone are volatile, minute traces of these are so detected.[6]

Examination for Pepsin and Rennet Ferment.—The presence of pepsin is shown by the ability of the gastric filtrate to digest albumin. A small portion of purified blood-fibrin[7] is placed in 10 to 20 ccm. of the gastric filtrate, and the whole maintained at a temperature of about 40° C. on a water-bath or in a warm chamber for several hours until the fibrin is dissolved. If the tests have shown the absence of hydrochloric acid or much diminished acidity, it will be necessary to add a small quantity of hydrochloric acid. If after some

[1] V. Jaksch, p. 103.

[2] *Loc. cit.*

[3] Leo, *op. cit.*, p. 106.

[4] Heat must be applied so long as moist blue litmus-paper held over the test-tube is even slightly changed in color.

[5] But see Roberts, *loc. cit.* Small quantities of these acids may be derived from foods containing them in the form of salts. Milk, butter, and cheese all contain more or less butyric acid existing free or combined. The butyrates are decomposed by hydrochloric acid.

[6] The scope of this work forbids the writer discussing in more than bare outline the qualitative application of these important tests, and quantitative methods cannot be considered. It may be stated that the least difficult of employment of the *reliable* quantitative tests for hydrochloric acid and the organic acids is that of Leo, fully described in his recently-published work, *Diagnostik der Krankheiten der Verdauungsorgane.*

[7] Blood-fibrin is preferable to egg-albumin. It is prepared for use by repeated washing in water until all discoloration by blood is removed, and is then preserved in glycerin. Before using a small piece is taken and again thoroughly washed to remove the glycerin.

hours the fibrin remains undissolved and develops an odor of putridity, pepsin is evidently absent.

The rennet ferment is readily detected by the addition of a few drops of the stomach-filtrate to a small quantity of unboiled milk, and placed in a warm chamber or on a water-bath at 40° C. A coagulum forms after the lapse of a few minutes or hours, surrounded by a clear whey if the ferment is present.[1]

The Motor Function of the Stomach.

Those movements of the stomach[2] by which the ingesta are intimately mingled with the gastric secretion, their solution promoted, and after digestion their absorption or gradual passage through the pylorus effected, may be diminished, constituting atony or motor weakness, frequently present in gastrectasia, acute and chronic gastric catarrh, and in some gastric neuroses; or they may be increased in degree, thereby inducing a too rapid passage of the only partly dissolved ingesta into the duodenum.

The propulsive action of the stomach is regarded by some as its chief function. Its diminution is considered by others, notably Klemperer,[3] as often the first symptom of gastric derangement, which later is followed by alteration in the secretory and other functions. As suggested by Kinnicut,[4] its estimation is not only of diagnostic value, but also of therapeutic and prognostic importance. Thus in cases of hypersecretion the preservation of motor efficiency implies the absence of

[1] Should no coagulum occur in this way, it may be presumed that rennet ferment is absent, though its antecedent, lab-zymogen, may not be. The latter may be shown by the addition of 2 cem. of concentrated $CaCl_2$ to the above mixture, and by placing the latter in a warm chamber as before. Coagulation, now occurring, indicates the presence of zymogen, which, through the action of hydrochloric acid generated by the addition of $CaCl_2$, is transformed into the rennet ferment.

[2] By a species of periodical rotation on its long axis, with walls contracted about the ingesta and orifices closed, the stomach effects the solution of food-masses and their permeation by the gastric secretion. By peristalsis the dissolved portions are passed from the fundus toward and finally through the pylorus. The necessity of these movements for efficient digestion can be readily shown outside the body by artificial digestion. Continued slight agitation of the vessel containing the digestive fluid and the albuminoid effects a much more ready solution of the latter, both by intimately commingling the two and by separating the peptone formed from the yet indigestible albumin.

In the glass beaker, as in the stomach, an accumulation of peptones is an obstacle to continued digestion. The gastric movements not only aid in removing the peptones formed on the periphery of the bolus, so that the digestion of its interior may be continued, but also, in Leube's opinion ("Diseases of the Stomach and Intestines," *Ziemssen's Cyclop. of Medicine*, vol. vii.), assist in the absorption of peptones by rendering the lymph- and blood-current more active.

[3] *Verhandlungen des Congresses für Innere Medicin.*, vii. Congress, Wiesbaden, April, 1889.

[4] *Loc. cit.*

ectasia, rendering the diagnosis more favorable. In gastric cancer, with diminution in or absence of the secretory function, with preserved motility, fair nutrition may still be maintained for a time by means of intestinal digestion. An estimate of the motor function may be made by several methods. That formerly in use (Leube's)[1] consisted in the introduction of the tube seven hours after a meal of soup, beefsteak, bread, and water, and the removal of what remained by washing out the stomach. Reduction of the motor action is shown by the wash-water containing portions of the ingesta, the amount varying directly with the severity of the muscular abnormality; all of the meal before the expiration of seven hours should have passed into the duodenum. This method, though useful in the detection of decided cases of atony and dilatation, is of less value in the recognition of medium degrees of the same. Leo[2] regards it of the greatest utility in the diagnosis of hypermotility. Thus if the stomach is found to be empty three hours after Leube's test-dinner and one and a half hours after Ewald's test-breakfast, this diagnosis may be made with certainty. The method with salol, originated by Ewald[3] and Sievers, consisting in the administration of 15 grains in wafer soon after a meal, was based on the fact that this drug, which escapes decomposition and absorption in the stomach, is split up by the alkaline juices of the intestines into its components, salicylic and carbolic acids, which are converted into salts absorbed and excreted by the kidneys, salicylic acid appearing in the urine as salicyluric, and may be detected in that fluid by suitable tests[4] in from one-half to one hour after its ingestion in cases of gastric euperistalsis, but not until a very much longer time in cases of lessened motility. Unfortunately for the accuracy of this test, so used, later experimentation by Rodeyjewski,[5] Brunner,[6] Huber,[7] Leo,[8] and others has shown that with presumably normal motility the intervals may vary considerably between the appearance of salicyluric acid in the urine and the ingestion of salol, two hours frequently elapsing before its detection.[9] Huber regards the time of disappearance of the salicyluric-acid

[1] *Deutsches Arch. f. klin. Med.*, Bd. 33, p. 8. [2] *Op. cit.*, p. 79.

[3] *Op. cit.*, p. 44, and also *Therapeut. Monatshefte*, 1887, No. 8.

[4] Solution of ferric chloride is added to the urine drop by drop. A violet color is developed should salicyluric acid be present. It may be detected in smaller amounts, and hence earlier, by acidulating the urine with HCl, agitating with ether, and subsequently testing the ethereal extract with iron-chloride solution.

[5] *Maly's Jahresbericht*, 1889, p. 196. [6] *Deutsche med. Woch.*, 1889, No. 7.

[7] *Münch. med. Woch.*, 1889, No. 19; *Centralbl. f. klin. Med.*, 1889, p. 803.

[8] *Loc. cit.*

[9] An interesting experiment, showing the influence of diet on the time of the appearance of salicyluric acid in the urine, and its probable cause, is described by Bourget (*Revue méd. de la Suisse Romande*, No. 12, 1888, quoted by Henry, "Diagnosis and Treatment of Functional Stomach Disorders," *Transactions Phila. Co. Med. Soc.*, vol. x., 1889), who found that after a simple meal of meat and a glass of water containing 2 per

reaction in the urine as a more certain test of the motor efficiency of the stomach, and proposes a modification of the salol test based on the fact that in healthy persons 1 gramme of salol taken after dinner will continue to show its presence in the urine for upward of twenty-four hours. But in cases of diminished gastric motility the reaction may still be obtained for from thirty-three to forty-eight hours.

To render the results as trustworthy and comparable as possible, a similar meal should be used in all cases in which the salol test is tried —one moderately easy of digestion and unlikely to originate an undue amount of acid or alkali. Recalling Bourget's results and their probable explanation, it is likely that in cases of hyperacidity, more especially when due to excessive secretion of hydrochloric acid, the salicylic reaction would be delayed somewhat without motor inefficiency existing. If the above precaution is observed and the latter point borne in mind, conclusions that can in the main be depended upon will be obtained.

The writer has found the salol test of considerable utility as a gauge of gastric motility by employing both Ewald and Brunner's methods at the same time. The patient is supplied with the ferric-chloride solution, and directed to examine a small quantity of urine at the expiration of half an hour after dinner and the ingestion of the salol, and to repeat the examination every fifteen minutes until response occurs. The duration of the interval is then noted, and the urine not again tested until the end of twenty-four hours from the time of taking the salol. Should a response still occur, the urine is tested at intervals of two or more hours until this ceases. If the response both occurs and disappears early, it is concluded that the motor function of the stomach is normal or in excess.

The method of Klemperer,[1] more recent than that of Leube or of Ewald and Sievers, though much less practicable, consists in the introduction by the tube of 100 grammes of olive oil into the empty stomach, and withdrawing what remains after two hours.[2] As oil is not

cent. of HCl the urine responded to the test for salicylic acid in from one and a quarter to one and a half hours, while after a meal of fruit, meat, and vegetables salicylurie acid could be detected in from fifteen to twenty minutes. The reaction of the fluid in the first part of the duodenum depends largely upon the quantity of acid poured into it from the stomach. If to the already acid gastric juice an additional quantity of HCl is added, neutralization of the alkaline fluid in the duodenum will result, and a considerable stretch of intestine may have to be traversed by the salol before sufficient alkalinity is present to decompose it. Conversely, by increasing the alkalinity of the intestinal juices, as may be effected by the ingestion of fruit, the organic acids of which are decomposed into alkaline products, the chyme will be entirely neutralized in the first part of the intestine, and the salol speedily split up.

[1] *Deutsch. med. Woch.*, No. 47, 1888.

[2] The oil should be removed by aspirating with water. It is then separated from the water, the remaining oil taken up with ether, and the ethereal solution placed in

absorbed from the stomach, the difference between the amount introduced and that withdrawn indicates the condition of gastric peristalsis. Klemperer ascertained by numerous experiments that normally from 70 to 80 gm. of oil are passed into the duodenum in two hours.

The Absorbent Function of the Stomach.—The condition of this is best ascertained by Penzoldt[1] and Faber's method: 2 or 3 grains of potassium iodide enclosed in a gelatin capsule, which is well wiped to remove all trace of the salt from its exterior, are ingested with a wineglassful of water on an empty stomach. The salt is absorbed from the stomach, and appears normally in the saliva in from six and a half to fifteen minutes. In diseased conditions in which absorption is tardy, such as gastric catarrh, dilatation, and cancer, the saliva may not contain it for several hours. It is recognized by the patient moistening with the saliva filter-paper which has first been saturated with starch paste and dried. A drop of fuming nitric acid is applied to the moistened spot, and if iodine is present a bluish discoloration is rapidly developed.

ACUTE GASTRIC CATARRH, ACUTE INDIGESTION, SIMPLE ACUTE GASTRITIS, INFLAMMATORY DYSPEPSIA.

The term "acute gastric catarrh" practically includes all forms of acute or subacute gastric disturbance indicated in the title of this section. It is dependent upon somewhat varied etiological factors, a special knowledge of the most direct of which is important from a therapeutic point of view. These are—a too free indulgence in the pleasures of the table, the ingestion of food or drink of irritating quality or an excessive quantity, and the use of indigestible aliment. The former includes very hot, cold, or indigestible food, spices, undiluted spirituous beverages, and certain drugs,[2] all of which probably originate acute catarrh through their local irritant action on the gastric mucous membrane.[3]

a bulb the weight of which is known. The weight of the oil is calculated after abstraction of the ether.

[1] *Berl. klin. Woch.*, 1872, No. 21.

[2] The drastic cathartics, for instance. The various corrosive poisons, such as oxalic acid, the mineral acids, salts of mercury, arsenious acid, lead, and others which cause toxic gastritis through actual destruction of tissue, are not now considered. Other drugs, such as opium, belladonna, chloral, the bromides, and the like, may predispose to gastritis through their local or indirect effect on the gastric functions.

[3] Increased acidity toward the end of gastric digestion is supposed by Brücke (*Lehrbuch der Physiol.*, 4 Aufl. Bd. i. p. 322) to excite reflexly, through slight irritation of the stomach-walls, the muscular movements leading to expulsion of the chyme into the duodenum. Anæmic conditions predispose to acute catarrh largely through

Excessive indulgence in food of proper quality induces gastric catarrh more indirectly. Secretion of gastric juice being inadequate for its thorough digestion, it remains an abnormally long time in the stomach,[1] and, besides irritating that viscus mechanically, it undergoes fermentation, as a result of which, through the action of micro-organisms, secondary chemical products develop which are irritating to the mucous membrane.

These factors are of course operative to a far greater degree in the debilitated and in febrile and anæmic conditions, when diminution in the secretion of gastric juice and impairment of motility are present, and lead to fermentative processes in the stomach. Then acute gastric catarrh may seem to arise spontaneously, though actually it is originated through impaired secretory and motor power.

The chief therapeutic indications in the management of acute gastric catarrh are removal of the exciting cause, allaying gastric irritability, and so resting the inflamed organ that it will return to its normal condition in as short a time as possible. Anorexia and certain local symptoms are often efficient in meeting the first indication without the physician's aid. Loss of appetite checks further excess in eating, and undigested aliment in the stomach, the more direct determining cause of the attack, is frequently removed by spontaneous vomiting, without a resort to emetics or the stomach-tube. In all cases arising through indulgence of the appetite beyond the digestive capacity of the stomach, stagnation of the ingesta occurs in this viscus through lack of secretion of gastric juice for their solution, and loss of sufficient motor tone to cause their onward passage through the pylorus.

The presence of undigested aliment is usually shown by epigastric uneasiness, fulness, and pain, belching of foul-smelling gases, nausea, and vomiting, and, though no food has been taken for more than forty-eight hours, unprovoked or induced emesis may lead to the expulsion of large quantities of partially-dissolved decomposing masses. With the above symptoms, should spontaneous emptying of the stomach not occur, vomiting may be induced simply and easily, if a condition of marked atony or dilatation be not present, by the ingestion of a pint or two of warm water containing a tea-spoonful each of sodium bicarbonate

diminution in the secretion of HCl. Insufficient secretion of gastric acid also probably induces catarrh through permitting septic processes to occur in the stomach which normally are inhibited by the presence of free HCl.

[1] A meal excessive in quantity and of substances inherently difficult of solution acts as an irritant to the gastric mucosa, as did the glass rod in the hands of Bernard on the dog's stomach. When the irritation was carried beyond gentle tickling, secretion of gastric juice and the rosy-red hue developed by a slight grazing of the surface disappeared, displaced by pallor, suppression of the secretion of gastric juice, and the formation of ropy mucus. It is suggested by Brunton (*Disorders of Digestion*) that similar changes take place in the stomach under the influence of undigested aliment, thus causing attacks of acute indigestion or gastric catarrh.

and table salt, followed by titillation of the fauces with the finger or a feather. Vomiting not being excited in this manner, or, after emesis, a continuance of the local symptoms indicating that the stomach has not been efficiently emptied, a resort should be had to the soft stomach-tube or an unirritating emetic. Though the tube is much preferable to the latter, it is often difficult to obtain the patient's consent to its introduction, its use appearing to one unaccustomed to its application sufficiently formidable to cause an emetic to be preferred. The advantages of the tube are that the stomach can be completely evacuated with trifling inconvenience to the patient and with but slight gastric disturbance, and that a thorough cleansing of its mucous membrane can afterward be effected,[1] promoting a far more prompt return to the normal than by the use of an emetic, which, however unirritating in its local action, may temporarily further derange the stomach, and perhaps induce a continuance of gastric irritability, which otherwise might have subsided after complete emptying of that viscus. Should, however, an emetic seem more expedient than the tube, one that acts rather by virtue of its systemic[2] effect than by local operation is to be preferred, and of the former apomorphine and ipecac should alone be used. Tartar emetic, much formerly resorted to, is now rarely employed, because of its highly irritating local action and the systemic depression it induces. Apomorphine is preferable to ipecac, since it may be administerd hypodermically—it being often desirable to employ that method of inducing emesis—and since but little nausea follows its introduction by the mouth or subcutaneously. It usually acts promptly in doses of $\frac{1}{16}$ to $\frac{1}{12}$ of a grain hypodermically, and from $\frac{1}{12}$ to $\frac{1}{8}$ grain by the mouth. Ipecac in doses of from 1 to 5 grains, administered in a wafer and repeated at intervals of half an hour until emesis occurs, induces vomiting in from fifteen to thirty minutes. Drinking warm water freely promotes its action.

Subsequent to the evacuation of the stomach-contents, or in place of this in cases in which the former seems unnecessary, an unirritating laxative should be administered if constipation, as is usually the case, be present. Effervescing salines may be employed, such as a Seidlitz powder, magnesium citrate, or other saline laxative combinations that are sold in the shops, or preferably calomel, succeeded in eight or ten hours by a saline should sufficient purgation not be induced by the latter alone. The experiments of Beaumont on St.

[1] For description of the method see Lavage in the treatment of gastrectasis.

[2] Probably all so-called systemic emetics introduced into the circulation through other channels than the stomach cause emesis by their local (reflex) effect, as well as through their direct action on the vomiting centre in the medulla, by their excretion from the blood into the stomach. It is certain that tartar emetic and ipecac do: the former causes gastro-intestinal irritation, however introduced. Apomorphine in the dose indicated is without injurious effect on the gastric mucous membrane.

Martin indicate that calomel has an influence little short of specific on the mucous membrane inflamed through dietetic errors. Morbid conditions of St. Martin's stomach, such as generalized erythematous, aphthoid, and ulcerated patches, associated with secretion of ropy mucus and even muco-pus, at times blood-tinged, a diffused thickening of the mucous membrane, with much vitiated gastric secretion, so frequently found to a greater or less degree as a result of too free indulgence in ardent spirits or from dietetic errors, seemed to be rapidly dissipated under the influence of full doses of calomel, either dusted upon the mucous membrane or administered in pill form. It is difficult to determine how much of this action of calomel in removing the morbid condition of the mucous membrane underlying an attack of gastric catarrh is local, due to its sedative and antiseptic effects, and how much remote through its cholagogue action. The latter is perhaps its chief, though not its entire, effect. Indiscretions in eating and drinking originate acute gastric disturbance and produce also an obstructed flow through the hepatic capillaries, inducing portal stasis through the conveyance of products of imperfect digestion and of decomposition from the gastro-intestinal mucous membrane to the liver.[1] Such venous engorgement will interfere with gastric and intestinal digestion, and this again reacts on the liver, inducing thus a vicious circle.[2] By a removal of these irritating products and a depletion of the liver, which calomel will effect, the circle is broken.

Believing that it is well to endeavor to obtain both the local and the cholagogue action of calomel, the writer is in the habit of prescribing it in trituration with sodium bicarbonate in doses of from 2 to 5 grains of the former to 5 or 10 of the latter. Sodium bicarbonate incorporated with it assists in the solution of the alkaline mucus, and enables the calomel to come into more intimate relation with the mucosa.

Following evacuation of the contents of the stomach, gastric irritability, should it continue—as it probably will, due as it is to an inflamed condition of the mucous membrane—is best allayed by the total withdrawal of all food for a limited time, confining the patient to bed, the application of counter-irritants in the form of sinapisms or a small blister to the epigastrium, and the administration of a few drops of dilute hydrocyanic acid with 5 to 10 grains of bismuth subnitrate rubbed up with glycerin or mucilage of acacia and exhibited in mint-water. Hydrocyanic acid has a remarkable sedative effect on the mucous membrane of the stomach. It is difficult to conjecture how the insoluble bismuth salts act, but they certainly enhance the efficacy of the other. Bismuth is frequently combined with carbolic acid, which also has decided sedative effects. The writer has frequently used this

[1] Brunton, *op. cit.*, p. 25, *et seq.*

[2] *Ibid.*, p. 26.

combination, essentially that suggested by Bartholow, with the happiest results:

℞. Acidi carbolici, gr. ¼;
Bismuth. subnitratis, gr. x;
Mucilaginis acaciæ, ♏xx–xxx;
Aquæ menthæ piperitæ, q. s. ad f℥ij.—M.
Sig. To be taken in a tablespoonful of water every one, two, or three hours.

Brunton[1] recommends the combination of potassium bromide with bismuth and hydrocyanic acid, because of its well-known effects in inhibiting reflex action, that of vomiting among others. His formula is—

℞. Bismuth. subnitratis, gr. x;
Potassii bromidi, gr. xv–xx;
Acidi hydrocyanici diluti, ♏v;
Spirit. chloroformi, ♏x;
Mucilaginis acaciæ, f℥ij;
Aquæ, q. s. ad f℥j.—M.
Sig. To be taken every three or four hours about ten minutes before food.

It is, however, probable that this combination would be more efficient without the bromide, which, though of service in cerebral vomiting, through its power, possessed also by morphine and chloral, to lower the irritability of the vomiting centre in the medulla, is little likely to be of avail in that originated by an inflamed condition of the gastric mucosa.

Morphine by the mouth, rectum, or subcutaneously is advised for the purpose of allaying gastric irritability, but in my experience it is usually badly borne, and tends later rather to aggravate than to ameliorate the trouble, probably largely through its provoking diminution of the gastro-intestinal and the hepatic secretions and increasing portal stasis.

[1] Brunton recommends in connection with the above formula the postural treatment for vomiting. A tendency to vomit is often increased by lying on the right side. Budge (*Die Lehre von Erbrechen*., p. 66) has attributed this to the greater pressure exerted by the liver upon the stomach in the position. Brunton, however, thinks the benefit derived from the sinestral position more likely due to the absence of any dragging on the stomach and the irritation it would cause, rather than to any change in the relations of the liver. He states that "the mere weight of the stomach itself and its contents will exert a drag upon it directed more or less toward its pyloric end, either in the sitting posture or when recumbent on the right side. The stomach is much more sensitive to any force exerted in this direction than to one toward the cardia, even in the normal condition, and it is likely to be still more so when rendered hyperæsthetic by inflammation."

The ingestion at frequent intervals of bits of ice or small quantities of iced carbonated water, such as Vichy, Seltzer, or Apollinaris, allays thirst and tends also to check nausea and vomiting.

The occurrence of acid and bad-smelling eructations demands the administration of an alkali, magnesia, chalk, or preferably sodium bicarbonate, combined with mild antifermentatives, such as bismuth salicylate and pulverized charcoal. The latter, though theoretically useless, since in the moist state its power to absorb gases is *nil*, actually is of decided benefit in allaying flatulence.[1] Sodium bicarbonate (or other antacid) must not, however, be used in too full doses or for too long a period in this disease, as it will not only neutralize acids arising through fermentation, but its use will tend to maintain the condition we are endeavoring to obviate by uniting with the natural gastric acid when the secretion of the latter becomes re-established, thus permitting fermentative processes to continue.

The pathological condition underlying acute gastric catarrh, as examplified in the case of St. Martin, indicates the necessity of putting the stomach in a state of complete physiological rest for as long a period as possible. With symptoms almost too slight to attract attention to the stomach, Beaumont observed patches of congestion and abrasion of the gastric mucosa, the presence of thick mucus and muco-pus, and a diminished secretion of gastric juice: with such a condition of affairs digestion was delayed from two to two and a half hours.

With preserved appetite and subjective and objective symptoms of mild catarrhal gastritis arising from gluttony or over-indulgence in alcohol, the pathological condition existed referred to on a preceding page; the gastric secretion consisted of bile and bloodstained, ropy mucus and muco-pus of a peculiarly fœtid and disagreeable flavor, without perceptible acidity.

Microscopical examination of the stomach of animals in which Ebstein artificially produced an acute gastric catarrh by the administration of alcohol, and in which the macroscopic alterations were of the character noted by Beaumont in St. Martin's case, showed also cloudiness, shrinking, and occasionally fatty degeneration of the gastric tubules. With such pathological changes, indicating for the time more or less complete suspension of the functional activity of the stomach, the latter is in no condition to functionate,[2] and nourishment must consist of such

[1] Brunton (*op. cit.*, pp. 68 and 215) suggests the plausible explanation of the efficiency of charcoal in checking flatus that it acts as a mechanical stimulant, its use in the stomach being similar to that of tooth-powder in the mouth. The small mechanical particles, brought into contact with the coating of mucus covering the lining membrane of the stomach in gastric catarrh, tend to remove it, and at the same time the friction they exert on the mucous membrane will also tend to increase the flow of blood through the vessels, stimulating them to absorption of gases.

[2] In all decided cases of acute gastritis secretion of HCl is much diminished or for

aliment as will undergo digestion in the duodenum, or feeding had better be done through the rectum. If the patient is well nourished and the attack has arisen through indiscretion in diet, with decided gastric irritability present, complete abstinence from food for twenty-four to thirty-six hours is indicated. Should the feelings of the patient or of his friends be against this, and it seem desirable that a certain amount of nourishment be given, and the stomach be in a condition to retain aliment, milk, containing sodium bicarbonate and common salt [1] or a carbonated alkaline water, may be administered in small quantities at frequent intervals.[2] Should milk thus administered not be well borne, peptonized milk,[3] peptonized milk-gruel,[4] or beaten-up eggs [5] may be tried. If more concentrated nourishment be indicated, a peptonized meat—preferably Mosquera's beef-meal or Mosquera's peptone-jelly—may be used. If the exigencies of the case demand rectal feeding, which should not be resorted to in gastric catarrh unless absolutely necessary, since it is always disagreeable

a time absent. Lactic and fatty acids, the products of decomposition, are present. The motor function is always diminished.

[1] Ten grains to each 8 ounces of milk.

[2] Roberts (*Digestion and Diet*, p. 181) calls attention to the fact that in the seriously sick with an almost paralyzed stomach milk is not acted upon in that viscus. "There is neither pepsin nor acid to curdle it, and it passes as a flowing liquid into the duodenum. Arriving there, it encounters the secretion of the still-active pancreas, and milk is especially amenable to the action of the pancreatic juice."

[3] Peptonized milk is very simply prepared by pouring a pint of milk and a gill of water into a clean quart vessel, and a tube of Fairchild's powder (containing 5 grains of pancreatic extract and 15 of sodium bicarbonate), or the same quantity of soda and 1 to 2 drachms of an active solution of the pancreas (of which the best in this country seems to be that made by Parke, Davis & Co.). The vessel is well shaken, and placed in warm water for half an hour or longer until a faintly bitter taste develops. It is then boiled for two or three minutes to check further action of the ferment, iced, and administered alone or preferably with carbonated water, which disguises the slight bitterness effectually.

[4] Peptonized milk-gruel is prepared by the addition of a measured quantity of hot thick gruel, made from wheaten flour, oatmeal, sago, pearl-barley, etc., to an equal amount of cold milk. This mixture will have a temperature of about 125° F. To each pint of this pancreatin and soda are added, as in the peptonization of plain milk. It is then set in a warm place for two or three hours, raised to the boiling-point, and strained. The bitterness of the digested milk is almost completely masked in the milk-gruel so prepared.

[5] These, in the more pronounced cases of acute catarrhal gastritis in which the stomach is unable to digest solid food, pass from that viscus into the duodenum unchanged, and are slowly digested in their transit down the intestine (Roberts, *op. cit.*, p. 186). A whole egg or its yelk may be whipped up with boiling water, strained, and added to a little light broth or clear soup (consommé). (See Yeo's article in Volume I. of this SYSTEM.) Or the white of several eggs may be thoroughly beaten and allowed to settle. A table-spoonful of this precipitate, added to 3 or 4 of sterilized water containing a little crushed ice and sweetened with sugar, glycerin, or saccharin, may be taken at intervals of two or three hours. A half tea-spoonful of brandy added to this improves the flavor, but would be inadmissible in the affection under consideration.

to the patient, such aliment should alone be used as is most readily absorbed from the bowel.[1] Preceding each nutrient enema the rectum should be emptied and cleansed with warm water.

During convalescence a general diet should be very gradually returned to. A small quantity of easily-digested solid aliment is first added to the liquid,[2] peptonized if desired, and later a more generous albuminous diet, such as stewed chicken, boiled mutton, and broiled tenderloin of steak, is allowed, each meal being succeeded at the expiration of half an hour by one or more doses of 10 to 15 drops of dilute hydrochloric acid, since deficient secretion of the gastric acid is apt to persist for some time after convalescence has been established. Too great care cannot be exercised to avoid the development of chronic gastritis or a condition of atonic dilatation.

Acute gastric catarrh, when due, as it occasionally is, to rapid changes of temperature causing a sudden chilling of the body after it has been overheated, is managed in much the same manner. The first indication, however, is a diversion of blood to the surface, which may be induced by the employment of pilocarpine hypodermically or the administration of a hot bath; subsequent chilling of the surface must be avoided by packing between blankets until the external body-temperature is lowered gradually to the normal. Free perspiration thus brought about will frequently rapidly jugulate a gastritis so arising, without resort to other measures.

Toxic Gastritis.—The management of toxic gastritis occurring in consequence of the ingestion of such corrosive substances as the mineral, carbolic, and oxalic acids, alkalies, phosphorus, arsenic, and other irritants which exert a corrosive action on the mucous membrane, resolves itself into the neutralization and removal of the irritant poison, the administration of demulcents to counteract its irritant local effect, supporting the powers of life until the dangerous period is past, and, finally, treating the resulting gastritis by the methods already indicated.

The corrosive substance swallowed is neutralized by its appropriate antidote. For acids a mixture of calcium, magnesia, and water may be used. This forms, with all the acids except oxalic, soluble harmless salts. If magnesia is not at hand, solutions of sodium carbonate, chalk, or soap should be administered. Ingestion of the caustic alkalies demands the employment of diluted acetic acid, vinegar, lemon-juice, tartaric acid; carbolic acid calls for soluble sulphates, or calcium hydrate or saccharate. Poisoning by phosphorus necessitates the use of sulphate of copper or the old, unrectified oil of turpentine, while the ingestion of arsenic calls for the hydrated sesquioxide of iron or magnesium

[1] See Rectal Feeding in Gastric Ulcer.

[2] The yelk of egg, fragments of stale bread or toast, pounded beef or chicken to broths or clear soup. (Yeo, Volume I. this SYSTEM.)

sulphate. Mucilages and oils are administered as demulcents after neutralization and evacuation of the alkalies and mineral acids.

In all cases of poisoning, unless due to corrosive or mineral acids, the stomach should be emptied and thoroughly washed out by the use of the stomach-pump or soft tube rather than by emetics. If neither the soft tube nor the stomach-pump is at hand, Ewald[1] suggests the employment of a piece of ordinary rubber (gas) tubing, to the distal extremity of which, in lieu of a funnel should the latter also not be procurable, the neck of a medicine-bottle may be attached, the bottom having been first removed.

CHRONIC GASTRIC CATARRH AND ATROPHY OF THE GASTRIC TUBULES.

Before considering the therapeutics of chronic gastric catarrh it is essential to have a definite understanding of what this term indicates. There has existed in no other branch of medicine a more utterly misleading classification of diseases than that adopted for those affecting the stomach. This is perhaps largely due to the fact that so-called dyspepsia, when not symptomatic, originated by a structural lesion, rarely shortens life, so that opportunity of comparing the complexus of symptoms with the *intra-vitam* pathological alterations observed after death have been few, and the character of these alterations have also been obscured by the early post-mortem changes which occur in the stomach-walls.

The terms dyspepsia, apepsia, bradypepsia, gastric atony, chronic indigestion, and the like have been and are still used by some interchangeably with the term gastric catarrh, entirely without regard to what may be the pathological condition underlying the symptoms. In Germany, with the teaching of the stomach-tube to compare with the results of clinical observation as a basis of diagnosis, a more correct nomenclature of gastric ailments, founded on pathological conditions as well as anatomical seat, has been formulated. Through the influence of German writers in this field we no longer diagnosticate "dyspepsia," employing the term to represent a morbid entity. Such ambiguous titles as apepsia, irritable, atonic dyspepsia, chronic indigestion, and others similar, indicative as they are of mere symptomatic conditions if they are not loosely used as synonyms of gastritis, are now employed to represent functional morbid states of the stomach induced and perpetuated by a disturbance of its nervous mechanism.[2] A correct

[1] *Klinik der Verdauungskrankheiten*, vol. ii. p. 275, 1888.

[2] *Vide* Ewald, *op. cit.*, p. 277.

understanding of this is absolutely essential for a successful therapy in gastric disorders.

With neuroses of the stomach, however, it is not the writer's province to deal. He can here scarcely do more than advise due caution in arriving at a diagnosis of chronic gastric catarrh where the possibility of a neurosis underlying the symptoms is in question, since the management of the former is entirely different from that of the latter; but if a wide difference exists in the treatment of the two conditions, the symptomatology of each is also so divergent—except perhaps in nervous anacidity and suppressed secretion due to atrophy of the tubules—that it requires no great power of discernment to distinguish the functional ailment from that with definite structural alteration.

A rational therapy necessitates at least a cursory knowledge of the minute anatomical alterations at the root of the symptoms. These changes, which cannot be considered here at length, may be said to consist essentially of a parenchymatous and interstitial inflammation of the secretory glandular structure of the entire mucous membrane of the stomach, especially in the pyloric region, leading to degeneration, atrophy, and abolition of function. In consequence, production of a proper digestive juice cannot occur, but in its stead there may be secreted an alkaline mucus which not only possesses no digestive activity, but which interferes chemically and mechanically with the function of the stomach.

Several forms of chronic gastritis are distinguished, differentiated by the result of examination of the stomach-contents removed fasting and after the test-meal by the tube in the manner already described. These are simple, catarrhal, and atrophic gastritis.[1] They all agree in that there is always an alteration in the character and a diminution in the amount of the digestive secretion, due to an organic affection of the mucous membrane involving the secretory glandular apparatus, and never hypersecretion or hyperacidity through increased formation of hydrochloric acid, which cannot result, in consequence of inflammation of the secretory structure.[2]

It is necessary that the principal characteristics of each form, as shown by an examination of the stomach-contents fasting and after

[1] This classification is that of Ewald, which is very convenient clinically. (*Vide loc. cit.*, and also *Deutsche Medizinal Zeitung*, May 6, 1889.) He also divides functional (dyspeptic) disorders into—(*a*) that with hyperacidity, in which a very acid gastric juice is secreted which digests promptly: in this form the fasting stomach is empty; (*b*) that with hypersecretion, in which the fasting stomach contains gastric juice: (*c*) subacidity or anacidity, that form in which secretion of hydrochloric acid is diminished or absent; (*d*) that with atony of the stomach, in which the gastric peristole is delayed, the ingesta remaining an abnormally long time in the stomach.

[2] As Ewald points out, the tendency of inflammation here, as in secreting glands elsewhere, must be toward cessation of function.

food, be surveyed, since the treatment, which in the main is similar in all, must be modified in some particulars according to the dominance of one or the other variety.

In simple gastric catarrh there is present during fasting small amounts of a mucous watery fluid, frequently bile-stained, and mixed with duodenal contents after removal by the tube. A precipitate of epithelial cells occurs from this on standing, containing numerous round cells and small amounts of food-remnants. After a test-meal, examination shows diminution in hydrochloric acid, pepsin, and the milk-curdling ferment. Peptone and albumoses are, however, formed within as well as without the stomach. Lactic acid and the fatty acids are apt to be present.

In the second variety, mucous gastritis, between which and the first transition forms occur, as they likewise do between mucous and atrophic gastritis, an abundance of mucus is present, both fasting and after food. The acidity is always low. Free hydrochloric acid is almost entirely absent. Peptone exists only in traces; proteoses, however, are formed abundantly. Digestion outside the body is impossible without the addition of hydrochloric acid, and even then it is retarded (showing diminution in pepsin); the milk-curdling ferment is much diminished or absent.

In the more advanced form, atrophic gastritis,[1] toward which the mucous variety gradually tends, during fasting and after food the stomach is quite empty and free from mucus; hydrochloric acid, pepsin, and the milk-curdling ferment are entirely absent, because of complete atrophy of the glandular secretory structure of the mucous membrane.

In the management of chronic gastritis, as in the acute form, our primary aim should be to discover, and if possible remove, the underlying cause, should it still be present, in order that if the gastritis has not advanced to pronounced structural alterations in the tubules a return to the normal may be more rapidly facilitated than if the treatment from the first were chiefly symptomatic.

Recurring attacks of acute gastric catarrh, arising chiefly through over-indulgence of the appetite, whether in food or drink, tend to provoke chronic gastritis. Antecedent acute gastritis may thus originate the chronic affection, or the latter may be occasioned primarily by the gradual action of similar causes operating in the production of the acute form. These the writer has already enume-

[1] While atrophy of the gastric tubules is usually secondary to chronic gastric catarrh, it may less frequently also occur idiopathically, due, as suggested by Meyer (*Zeitschrift f. klin. Med.*, Bd. xvi. p. 363), to disease of Auerbach and Meissner's plexus or of the vagus or sympathetic. Meyer has entitled this form gastric phthisis. It is most common in the aged: the symptoms are those of pernicious anæmia.

rated: they need not be reconsidered. Other causes are the presence of functional gastric derangements, the forms of nervous "dyspepsia" just alluded to, which produce weakness, irritation, and subsequent inflammation of the gastric mucous membrane, through the latter being unable to act properly. Gastric disorders of this type merit prompt and careful attention, lest they gravitate into chronic gastric catarrh or ulcer.

Obstruction to the portal circulation, however brought about, whether by disease of the lungs, heart, or liver, or by anæmic conditions producing weakened heart-action and slight ischæmia, causes gastric catarrh through the mechanical (or passive) congestion of the stomach induced. Ailments thus originating catarrh of the stomach must receive attention before the local gastric conditions can be improved, otherwise remedial measures directed solely to the stomach will be inoperative.

Obstructive disease of the heart and lungs demands such medicaments as digitalis, strophanthus, caffeine, strychnine, and arsenic—agents which remove ischæmia and support the circulation, both directly and indirectly, through their effect on nutrition. If it be necessary to use digitalis or strophanthus for a more or less continuous period, the latter should perhaps first be tried, since, though usually not quite so efficient as digitalis, it is not only without irritating effect on the stomach, but acts as a mild stomachic. Digitalis,[1] on the contrary, is a gastric irritant, and, though its effect in this direction is quite insignificant in comparison with its beneficial influence in removing impediments to the circulation, it is preferable not to resort to it if a substitute can be found. Digitalis might first be used for a short time, until the condition of ischæmia is removed; the equalized circulation may then be maintained by strophanthus and arsenic. When decided anæmia accompanies a failing circulation, arsenic is often more efficacious than digitalis, as was pointed out by Bramwell. The fact that arsenic has a decidedly stimulating effect on gastric digestion, causing pepsin-hydrochloric acid to dissolve a much larger amount of albumin than would be digested were it not present,[2] renders it specially useful in gastritis originated and main-

[1] Leube (*Ziemssen's Cyclopædia*, vol. vii.) is of the opinion that though digitalis causes anorexia, nausea, and vomiting, it should still be employed in gastritis due to obstructive pulmonary and cardiac affections, since the equalization of the circulation it produces will be accompanied by a corresponding amendment in the gastritis. He believes that in those cases in which the cardiac condition is improved without a corresponding amelioration in the gastritis the latter is due to another cause than venous congestion. However this may be, if another drug less irritating to the stomach can replace digitalis, it should of course be used where the function of the latter is disturbed.

[2] As has been shown by Chittenden, *Medical News*, Feb. 16, 1889.

tained by cardiac disease. Free purgation to unload the portal circle is frequently necessary in gastritis due to heart disease, as it is in that arising from disease of the liver. Blue mass, calomel, podophyllin, colocynth, and such salines as sodium sulphate and phosphate, all of which have both a cholagogue action and a depletory effect on the engorged portal viscera, are especially useful. Passive congestion of the stomach causing gastric catarrh, arising through enfeebled heart-action induced by idiopathic or secondary anæmias, requires similar treatment—strophanthus as a heart-tonic; arsenic, strychnine, and iron (with laxatives) to stimulate hæmogenesis.

Wasting diseases and all sources of malnutrition, such as phthisis, chronic malaria, cancer, nephritis, neurasthenia, and old age, predispose to chronic stomach catarrh by the induction of anæmia, gastric atony, and probably degeneration of the vessels of the stomach.[1] The therapeusis of cases of this sort is that of ordinary chronic gastritis, the anæmia and its cause not being overlooked

The remote cause of gastritis having received consideration, we should direct our efforts toward removing the more direct one depending upon the former—an abnormal condition of the stomach permitting fermentative processes to occur—instituting and maintaining a healthy state of the mucosa, and so stimulating its glandular apparatus that the elaboration of a proper digestive fluid will result, the utmost caution being observed during the process of cure that the affected organ is not overtaxed by injudicious feeding. The treatment of special symptoms, such as arise through indigestion and fermentation of the ingesta, must also engage our attention. The habits of the patient should be carefully scrutinized, all those prejudicial to health being corrected. Systematic exercise in the open air, regularity in eating, thorough mastication of food, attention to skin and bowels—in short, all that pertains to general hygiene—demand and must receive as much consideration as the medicinal treatment itself.

In cases of mucous gastritis, in which the lining membrane is covered with a thick, tenacious layer of alkaline mucus, permitting fermentative processes to occur, and both interfering with the elaboration and causing the neutralization of the proper gastric juice, and in those cases of simple gastritis and of gastric atrophy in which, through atony of the mucous membrane, stagnation of the ingesta occurs, it is absolutely necessary, in order to fulfil the first indication above mentioned, that washing out of the stomach be systematically practised.[2] This should be done at least once daily, preferably an hour before breakfast; if twice daily, the second washing should be about an hour before the evening meal and at least five hours after the preceding meal.

[1] Flint in *Reference Handbook of the Med. Sciences.*

[2] The method of lavage is described under Gastrectasia.

Lavage is not only of the greatest utility as a cleanser, removing from the stomach mucus and remnants of undigested food, but it also ranks high as a stimulator of glandular activity. The utility of lavage in this direction is so decided that it cannot well be replaced by the ingestion of fluid to be absorbed from the stomach or to pass onward through the bowel. Lavage should be resorted to in all cases of gastritis, even though unattended by the formation of mucus, in which there is persistent diminution in the formation of hydrochloric acid.

In cases of mucous gastritis the wash-water should preferably be sterilized by boiling. It should be introduced warm, and may be either plain or medicated. When our object is simply to cleanse the stomach-surface in cases characterized by a free secretion of mucus, alkalies having a solvent action on the latter are to be used, such as sodium bicarbonate and chloride, a tea-spoonful or more to the pint.[1] If fermentative processes are occurring actively in the stomach, as shown by the presence of large amounts of the fatty acids, the addition of antizymotics to the wash-water may be necessary. Each washing should be continued until the fluid returns through the funnel clear and free from mucus, care being taken that the stomach is finally entirely emptied when the wash-water contains substances, such as borax, which if left in the stomach might irritate that viscus. If our chief object in resorting to lavage is to stimulate the secretory function, no agent is more beneficial than sodium chloride, which, absorbed into the blood, not only contributes toward the production of hydrochloric acid, but also promotes the transformation of pepsinogen into pepsin.

It requires but few applications of lavage in suitable cases for benefit to be apparent. Improvement is soon so decided that the patient, if at first averse to the use of the tube, becomes accustomed to its manipulation, and could not readily be persuaded to abandon it. Ewald[2] regards no remedy of greater service in the

[1] It is perhaps better in all forms of gastric catarrh to use an alkalinized water, preferably containing sodium bicarbonate and chloride, since in all forms of stomach catarrh diminution of secretion of pepsin-hydrochloric acid occurs. Both of these sodium salts, when employed in small amount, stimulate the elaboration of gastric juice. One of the methods in use (Leube, *Deutsches Archiv f. kl. Med.*, Bd. 33, p. 12) for ascertaining the condition of the secretory activity of the peptic glands is based on this well-known stimulating power of alkalies, especially of sodium carbonate, on the secretion of pepsin-hydrochloric acid: 50 ccm. of a 3 per cent. solution of sodium are introduced into the fasting stomach, cleansed by lavage, and after twelve minutes are withdrawn through the tube by the aid of 500 ccm. of lukewarm water. If the water fails to react acid, a decidedly diminished secretion or suppression of the gastric juice exists. (For the influence of sodium carbonate on the secretion of gastric juice in chronic gastritis, see also Leube, *Ziemssen's Cyclopædia*, Am. ed., vol. vii. p. 189.)

[2] *Klinik der Verdauungskrankheiten*, p. 298.

treatment of chronic gastric catarrh. He states that cases which have been subjected to all varieties of treatment save lavage for months or years without benefit, have been either rapidly improved or entirely cured by the latter; employed, of course, in conjunction with other rational measures which alone have been inefficient. My own experience, though less extensive than Ewald's, is in accord with this.

When lavage is impracticable, whether because the case is too mild to require it or the prejudices of the patient forbid its use, the ingestion of half a pint to a pint of hot water containing a little sodium bicarbonate and common salt may be substituted for it. This should be taken on the empty stomach in the morning and before the last meal of the day, at the time recommended for lavage, or in its place, when available, one of the more palatable natural saline waters may be drunk, such as the German Kissingen (Rakoczy) or Wiesbaden (Kochbrunnen), as recommended by Boas,[1] the use of which for periods of three or four weeks in cases of diminished gastric secretion he has found induces an increase. These waters consist essentially of a weak solution of common salt and of alkaline carbonates, especially that of sodium, and can, for all practical purposes, be replaced by the addition of sodium chloride and bicarbonate to ordinary water. Natural saline waters of our own country which resemble in composition the German spring waters are also very numerous. There seems no doubt as to the efficiency of sodium chloride and sodium bicarbonate, when taken fasting in small quantities, as stimulators of gastric secretion. Abundant experimental and clinical evidence has shown their great value. The action of sodium bicarbonate in this direction seems to be entirely local,[2] while that of common salt is both local and systemic. "An acid on one side of a secreting membrane, an alkali on the other, is the condition most favorable for osmosis" (Bartholow). Small doses of sodium bicarbonate ingested on the empty stomach stimulate an outflow of gastric secretion, which it in part neutralizes: after the neutralization of alkali the flow continues, and is decidedly greater in amount than if its secretion has not been thus induced. If taken in decided doses, whether during fasting or after food, the gastric secretion is neutralized and digestion disturbed. Absorbed into the blood in large amounts, the alkalinity of that fluid is increased and diminished secretion of hydrochloric acid is likely to result.

The effect of sodium chloride on gastric secretion and digestion

[1] *Diagnostik und Therapie der Magenkrankheiten*, p. 262

[2] It would seem that all CO_2 waters powerfully stimulate the secretion and absorption of the stomach (Ewald, *op. cit.*, p. 300). So that the special action of sodium bicarbonate is not alone due to its base. The contact of CO_2 with the mucous membrane of the stomach not only excites the secretion of gastric juice, but also assists in ridding the stomach of the various gases present through fermentation (Leube).

seems to differ somewhat according to whether it is taken on an empty stomach or during digestion. The more recent experiments of Roberts and others[1] with artificial digestive mixtures show that common salt, introduced into the mixture in even very small quantities after digestion has begun, has a very considerable inhibitory effect on this process, and with 0.5 per cent. (or 1 : 200) this retardation is so great as to check further digestive action. This would appear to be due in some way not comprehended to the influence of sodium chloride, as of other salts (the action of which we can more easily understand), on the gastric juice already secreted, rather than on the mechanism of elaboration. In this connection it is of importance to note a highly significant fact pointed out by Sherican Lea[2] in comparing the results of artificial digestion and of normal gastric digestion, as it may explain the contradictory conclusions reached by clinical and laboratory experimenters in this field.

Lea points out that the conditions under which the two processes occur are very dissimilar. In natural gastric digestion, in addition to fresh secretion of gastric juice continually being produced, constant movement of the chyme is taking place, and the products of the metamorphosis of the ingesta are being incessantly removed. Conditions, therefore, are very favorable for rapid absorption of a soluble salt, such as sodium chloride, little remaining in the stomach to interfere with the digestive process unless much has been introduced; so that the inhibition of digestion that occurs in the test-tube is probably not repeated normally in the stomach.

The local effect of common salt in small amount is stimulating to pepsin-hydrochloric-acid formation and to the transformation of pepsinogen into active pepsin. Systemically, it unquestionably contributes to the formation of the gastric acid,[3] the production of the latter entirely ceasing during sodium chloride starvation, as Cahn[4] and Voit[5] have shown.

The frequent use of mild saline laxatives, particularly waters containing sodium chloride and bicarbonate, besides their special laxative salt (preferably sodium sulphate), is of distinct service in synergizing the effect of lavage in cleansing the stomach of mucus, promoting a healthy condition of its walls, and influencing its functions generally for good, even when lavage alone, as commonly happens, promotes

[1] Boas, *op. cit.*, p. 261. See also Roberts, *Digestion and Diet*, Phila., 1891, p. 146, *et seq.*

[2] *Journal of Physiology*, p. 226, vol. xi., 1890.

[3] The source of the hydrochloric acid is undoubtedly the sodium chloride of the blood and lymph (Landois and Stirling, *Physiology*).

[4] "Die Magenverdauung im Chlorhunger," *Zeitschr. f. Physiol. Chem.*, Bd. x., p. 522, *et seq.*, quoted by Boas, *op. cit.*, p. 261.

[5] Landois and Stirling, *loc. cit.*

regular alvine evacuations through its stimulating effect on gastric and intestinal peristole.

Saline laxatives also relieve the engorged condition of the mucous membrane by their depletory influence on the portal circulation. Carlsbad waters and salts,[1] which consist essentially of sodium sulphate, bicarbonate, and chloride, are of special value if not employed too continuously or in too great quantities.

Ewald and Sandberg's[2] recent investigations into the influence of these waters on the gastric functions show that their absorption is very rapid, especially when ingested warm; that they have a much greater stimulating influence on the stomach than simple water, decidedly augmenting gastric secretion, the hydrochloric acid, pepsin, and rennet-ferment being greatly increased after a time; and that this influence is maintained even after a five or six weeks' course of the waters.

No remedy has been more widely used than silver nitrate in chronic catarrhal conditions of the gastro-intestinal tract. The extended employment of this salt would indicate its utility, which seems, however, founded on no definitely known physiological effect. It is said to possess sedative, astringent, and alterative properties. However it may act in promoting a healthy condition of the mucosa in gastric catarrh, the fact that it is of benefit in moderate doses, in connection with the use of the stomach-douche, is undoubted, and a lack of a clear conception of

[1] There is now prepared in Carlsbad, after the formula of Professor Ludwig of Vienna, and sold in this country through the Elsner & Mendelson Co. of New York, Carlsbad salts in powder form, representing all the saline ingredients of Carlsbad water. It is termed "Natural Carlsbad Sprudel Salt in powder form." Its formula is:

Lithium bicarbonate .	0.39 per cent.	Sodium fluoride	0.09 per cent.
Sodium bicarbonate . .	35.95 "	Sodium borate	0.07 "
Sodium sulphate . . .	42.03 "	Silicic acid anhydride .	0.03 "
Sodium chloride . . .	18.16 "	Iron oxide	0.01 "
Potassium sulphate . .	3.25 "		

This powdered Carlsbad salt is infinitely preferable in cases of gastric catarrh to the crystallized Sprudel salt prepared after Becher's formula, which is also largely used. The latter's chief ingredient is sodium sulphate, it containing less than 1 per cent. of common salt and but 5 per cent. of sodium carbonate. The crystalline salt should be used in those cases in which a cholagogue and purgative action only are desired. The powdered Sprudel salt, on the contrary, quite well replaces the water. According to Jaworski, who has elaborately investigated the subject (*Action, Therapeutic Value, and Uses of Carlsbad Sprudel Salt* (powder form), translated by Toboldt, P. B. Blakiston, Phila.), this salt has very nearly the same therapeutic effect on the stomach as the Carlsbad water, though it is less stimulating. Jaworski found that the gastric juice becomes capable of peptonization earlier, and that the stimulating effect on secretion lasts longer, after the water than the salt. He also noted that while warm Carlsbad water is more stimulating to the gastric function than cold, the contrary is the case with the salt; which latter should therefore be administered in cold solution if the object is to stimulate gastric secretion rather than intestinal peristalsis.

[2] *Centralbl. f. med. Wissensch.*, 1888, p. 396.

its effects should not militate against its employment on the face of the clinical evidence in its favor. It is of far more utility as a sedative and astringent than bismuth, much used in the same class of cases, and should be administered in doses of $\frac{1}{8}$ to $\frac{1}{4}$ grain three times daily, combined with a small quantity of belladonna or opium, a half hour or more before meals, when gastralgia or deep-seated tenderness, indicating a pronounced inflammatory condition of the stomach, is present. This may be continued for a month or six weeks, and after an intermission again resorted to should its employment seem to have been of benefit.[1] Subacute inflammatory conditions of the stomach accompanying chronic gastritis, especially that of drunkards, in which the tongue is abnormally red and the papillæ prominent, are often quickly relieved by zinc oxide in 3- to 5-grain doses, or a preparation of bismuth, the subnitrate or carbonate, in doses of 5 to 20 or more grains. These may be administered alone or in combination with dilute hydrocyanic acid, or with morphine if decided epigastric tenderness exists. They should, of course, be taken on the empty stomach.

In addition to the steady employment of lavage, or the use of large draughts of the saline waters on an empty stomach half an hour to an hour before meals, once or twice daily, as a cleanser of the mucous membrane and as a stimulant to the secretory activity of the stomach, other agents exerting an influence for good in the latter direction also deserve special notice. The chief of these is hydrochloric acid, the use of which serves a triple purpose in chronic gastritis. It stimulates the formation of pepsin, and perhaps its own secretion: it acts as a digestant when its secretion is diminished, and as an antizymotic, inhibiting fermentative processes which constantly occur in the stomach in this disease through lack of formation of hydrochloric acid and because of diminished peristole. As a stimulator of glandular activity hydrochloric acid takes high rank. It is, however, indicated for this purpose only in cases in which complete atrophy of the tubules does not exist, when free hydrochloric acid is still secreted, even if only in traces, as is shown by the digestive test outside the body. Should the gastric filtrate alone, or with the addition of hydrochloric acid, digest egg-albumin or blood-fibrin, and if the lab-test is positive, hydrochloric acid may be employed with benefit.[2] Under its use, especially when

[1] A word of warning is here necessary regarding the dose of silver nitrate frequently advised. The use of a grain three times daily, the maximum given in many textbooks, is not unattended with danger, and should not be prescribed except, perhaps, in gastric ulcer, where the benefit anticipated from its employment for a short time seems greater than the risk encountered from the use of a dose so large. Apart from the danger of argyria from its continued use, neuritis and kidney degeneration may occur. Gowers (*Diseases of the Nervous System*, p. 321, 1888) states that a grain a day has been said to cause fatal kidney disease, and he has seen a case in which a much smaller dose, taken daily for nine months, caused albuminuria.

[2] Boas, *op. cit.*, p. 249.

combined with common salt, secretion of a more active gastric juice occurs spontaneously.[1] Its mode of administration will be discussed under that of Artificial Digestants.

The employment of some of the so-called stomachics, though of less utility in chronic gastric catarrh than the secretory stimulants already mentioned, deserves attention. The chief of these is certain of the bitters, the influence of which, however, on the secretory process in gastritis is less beneficial than in functional (nervous) atony of the stomach.

When, however, a subinflammatory condition is present, as in slight cases of gastritis or in the more severe forms of mucous catarrh ameliorated by careful diet and lavage, in which the tongue has lost its angry appearance, and it would seem that a mild stimulant is all that is necessary to provoke healthy glandular activity, the bitters, such as nux vomica, quassia, calumba, condurango, and gentian, may be of great utility. But for the purpose of stimulating secretion they should be administered, unlike hydrochloric acid, before and not after meals. Though their mode of action is somewhat doubtful, their effect in suitable cases is very certain. In the mouth they increase salivary secretion, and thus aid starch digestion. In the stomach in small doses the slight irritation they cause may be interpreted as appetite.[2] As suggested by Brunton, when appetite is thus induced putrefactive processes which might otherwise occur in the stomach, and that languor and discomfort which accompany impaired digestion, are diminished. The effects of bitters are probably due entirely to the promotion of a better secretion of gastric juice. The most recent investigation into the influence of bitters on the stomach during digestion is that of Reichmann,[3] who examined into their direct influence on the secretion of the fasting stomach, on their effect subsequent to their disappearance from the stomach, their action when employed for some time, and the influence exerted on the duration of digestion. He found that though the secretion immediately produced during fasting by bitters was less in amount than that induced by distilled water (its digestive

[1] Boas, *op. cit.* According to this author (p. 249), who doubts the generally-accepted notion as to the utility of hydrochloric acid as an artificial digestant in cases in which its secretion is much diminished or entirely absent, the administration of hydrochloric acid is useless except as an antifermentative, and it should not be employed if the digestant test for pepsin and lab-ferment, reinforced by hydrochloric acid, results negatively.

[2] Brunton (*op. cit.*, p. 144) suggests that appetite is only an expression of mild uneasiness on the part of the stomach. The latter not being able to distinguish sensations, as does the mouth, when very slightly stimulated develops appetite. Thus, quassia, which causes a bitter taste, and minute doses of tartar emetic and arsenic, which would produce congestion if they remained in the mouth as they do in the stomach, all cause appetite. They probably do this by exciting a slight amount of hyperæmia.

[3] *Centralbl. f. med. Wissensch.*, p. 618, 1888.

power being slight with hydrochloric acid diminished or absent), after the disappearance of the bitter from the stomach the secretion was greatly augmented, the quantity of hydrochloric acid and the digestive power much increased. He also found that during digestion in a healthy stomach bitters diminished digestive activity; that in lessened secretion and in hypersecretion acidity was increased, but in anacidity no effect was produced; and that no ill resulted from the prolonged use of bitters in healthy or diseased stomachs. These experiments confirm a fact already established empirically, that bitters are of most benefit where digestion is imperfect through diminished production of gastric juice, and that they should be administered before (preferably at least half an hour) and not after meals. Nux vomica is probably the most useful of the bitters, it having a special stimulating action on the nerve-centres by which the co-ordination of the digestive process is rendered more perfect.[1] It may be given in the form of tincture in doses of from 5 to 20 drops. When Carlsbad or other saline water is taken once or twice daily before meals, the tincture of nux vomica or other bitters employed may be added to the water, the action of which will thus be synergized. The tincture of nux vomica or one of the bitter infusions, such as quassia or calumba—these latter in doses of $\frac{1}{2}$ to 1 fluidounce—may be prescribed in combination with 10 or more grains of sodium bicarbonate, to be taken in hot water half an hour before meals. This the writer frequently uses with the best effect. Cannabis indica, in doses of 5 to 10 minims of the tincture and $\frac{1}{4}$ to $\frac{1}{2}$ grain of the extract, has recently been highly extolled in gastric disorders in cases in which acids and nux vomica seemed inefficient. The alkaloid strychnine, or preferably its more soluble sulphate, is often of greater value than nux vomica, especially in the gastric catarrh of drunkards. It may be given in doses of $\frac{1}{60}$ to $\frac{1}{20}$ of a grain, after meals, in combination with hydrochloric acid, or before meals in pill form, or, when an alkali is not taken, dissolved in dilute hydrochloric or nitro-hydrochloric acid.

Condurango, belladonna, and ipecac are also useful as stomachics. With the former, which Ewald employs in combination with dilute hydrochloric acid, the writer has had no experience. The effect of belladonna as a peristaltic stimulant is unfortunately counterbalanced by its influence in diminishing secretion; hence, according to the writer's opinion, it had better not be resorted to save in small doses, united with laxatives, at bed-time. Ipecac, as a laxative, is efficient also as a stomachic, combined with aloes or other purgatives, in pill form and administered after meals.

Of orexin muriate, a benzyl derivative, proposed by Penzoldt[2] as a promoter of gastric secretion and of appetite, of which at first so much

[1] Brunton, *op. cit.*, p. 68.

[2] *Therapeut. Monatshef.*, p. 59, 1890.

was expected because of Munter's and Penzoldt's investigation,[1] little more need be said than that the results of its earlier use have not been confirmed by later experiments, and that if it be thought worthy of trial it should preferably be exhibited in wafer, paper, or gelatin capsules, since pills made of it do not readily undergo solution in the stomach. The dose as employed by Penzoldt was from 5 to 7 grains once to twice daily. A burning sensation in the œsophagus and occasional vomiting were observed after its ingestion, to avoid which Penzoldt recommends that a large cup of beef-tea be taken along with it.

Alcohol, or beverages containing it, so useful as a stomachic in conditions of simple atony of the mucous membrane, is harmful in gastritis, and if employed at all should be only in the form of a light wine. In drunkards' catarrh it is sometimes difficult to withhold stimulants, the cause of the gastritis. These subjects are often unable to take the morning meal until a small quantity of spirits has been imbibed, which not only assuages nausea, but enables them to take, retain, and digest food when they otherwise could not. In these, morning lavage to remove stomach-mucus, or a tumbler of warm solution of Carlsbad salts, the former succeeded by the latter, which may contain 10 or 20 drops of tincture of nux vomica, will often be found to remove the craving for alcohol and disgust for food, the latter of which, unless predigested, should be succeeded by dilute hydrochloric acid.

Douching and massage of the stomach are recommended as secretory exciters. They are of more value in cases of decided muscular atony as stimulators of peristole, and will be considered in the treatment of Atonic Dilatation. That the intraventricular application of both faradic and galvanic electricity has the power not only to increase gastric motility, but also to excite secretory activity in both normal and diseased stomachs, there is no doubt, though its exact value as a curative in gastric diseases is still *sub judice*, experimentation with the direct application in these being of comparatively recent date, and not yet extensive enough to permit of generalization of results. Most perhaps may be expected from electricity in cases of diminished secretion due to simple or nervous atony, and least in cases in which a marked inflammatory element exists or where decided atrophy of the tubules has occurred.

Though the ability of both currents to increase secretory activity has been established by experimentation, faradism has been more resorted to than galvanism; and, curiously, good results have been obtained with the same current similarly applied in antithetical cases of gastric disorder, those with hyper- as well as subacidity yielding to its employment. Stockton[2] is inclined to seek for an explanation of

[1] The former of whom noted the appearance of free HCl in the gastric secretion in from a half hour to one hour earlier after its use than when it was not employed.

[2] "Results of Gastric Faradization," *Amer. Journ. Med. Sciences*, July, 1890.

this through the beneficial influence of electricity upon innervation, a disorder of which, he believes, underlies both classes of ailments. Einhorn,[1] who has recently reviewed the literature of electricity in diseases of the stomach, in describing an excellent electrode which he has devised for its application—much more convenient than any before constructed—after citing three cases (normal) in which, fasting, a few minutes' intraventricular application of faradism decidedly increased acidity, inducing a response to Günzberg's test, which previously could not be obtained,[2] reports markedly beneficial subjective and objective results (the latter shown by chemical tests) in chronic catarrh of the stomach. In two aggravated cases in which free hydrochloric acid could never be found after the test-meal, it could be detected after the stomach had been faradized internally for ten minutes. In view of these results, which are but a confirmation of those obtained by others,[3] it would appear that there is much to expect from the direct application of electricity in diseases attended with secretory inactivity, and its usefulness seems equally happily exerted on the absorbent and motor functions, both of which are more or less affected in gastritis. Theoretically, for reasons which lack of space forbids us to detail, galvanism, with the anode in the stomach and the cathode externally, should be preferred when it is desired to stimulate secretion and absorption; and faradism, when it is desired to excite the gastric peristole. However, it would appear in practice that more striking results have been obtained in all the directions with faradism, the use of which, therefore, the writer would recommend in all cases of gastritis not yielding to simple remedies, in which there is a decided and persistent diminution in the formation of hydrochloric acid.

The lack of a convenient electrode for direct electrization has caused this method of application until quite recently to be but little resorted

[1] *Medical Record*, May 9, 1891.

[2] His method in these was first to ascertain the condition of the stomach fasting, testing the removed contents, if any, for free hydrochloric acid: 100 ccm. of water and the electrode were then introduced and permitted to remain for ten minutes, no current passing. The electrode and the stomach-contents were then withdrawn, and the total acidity of the latter and its response to hydrochloric acid by Günzberg's and other tests noted. The electrode and 100 ccm. of water were again introduced, the current closed by the subject grasping the second electrode in the hand, and a mild faradic application made for ten minutes. The stomach-contents were then re-examined, with the result above cited.

[3] The writer has not yet employed the intragastric application of electricity with sufficient frequency in any one class of cases to form more than an approximate idea as to its utility. He may, however, state that the results obtained are favorable as to its use in cases characterized by lessened secretory and motor activity. He has recently used entirely the Einhorn electrode made for him by Otto Flemming of Philadelphia. This is unquestionably more convenient than that of Bardet or any modification of the latter, such as Stockton's. Einhorn's electrode is manufactured in New York City by Messrs. John Reynders & Co.

to, and forced Ziemssen[1] to abandon it after a trial as too straining and exhausting, he having used an electrode introduced through the stomach-tube. However much the percutaneous applications may influence gastric peristalsis, electricity thus used can be of only the slightest service as a secretory excitant, especially faradism, the penetrative power of which is almost *nil*.

The electrode devised by Einhorn, which is as easy of application as it is of ingenious construction, removes the objectionable feature of its predecessors, that of having to retain in the throat during the whole time of the electrical session a thick tube, the sensation of which, except to those accustomed to the use of the tube for lavage, is so highly unpleasant as to cause a desire to forego its application. Einhorn's electrode consists of a small hard-rubber, numerously perforated, oval capsule, joined near its centre by a screw-thread, by which it may be separated, containing in its interior a small metallic button, about which absorbent cotton is placed to prevent the stomach-walls coming in contact with the button through the perforations. The capsule is united to a fine rubber tube (1 mm. in diameter), through which a very fine, soft conducting wire runs, connecting the electrode with the battery. The mode of application of this electrode is similar to that of those applied through the stomach-tube. A half pint to a pint of warm water, simple or saline, is ingested fasting, preferably half an hour or an hour before a meal, and the electrode swallowed. The latter is readily accomplished by placing the electrode on the root of the tongue and taking a draught of water. The electrode is washed into the pharynx and more water drunk; it then readily slips into the stomach. The rubber tube should contain a distinguishing mark at a distance of about 40 cm. from the capsule, that it may be known when the latter has reached the stomach. The indifferent large electrode is placed on the back to the left of the seventh dorsal vertebra or in front at the epigastrium, or held in the hand, and the current turned on and slowly increased until it is slightly felt. Subsequent to the application the electrode is readily removed by drawing gently at the rubber cord. If resistance is felt at the introitus œsophagi, the patient is directed to swallow; the electrode is then liberated, and is easily withdrawn without force being applied. Before this the current should have been gradually diminished, shocks being avoided. If galvanism is used the current should be controlled by a rheostat. The duration of the sitting should be about ten minutes and the applications made daily.

When our object is secretory rather than motor stimulation, considerable strength of current should not be used, lest by over-stimulation we defeat the end in view. The stomach containing considerable fluid during the application, the current is diffused throughout its sur-

[1] Quoted by Einhorn, *loc. cit.*

face, and comes into contact with all parts at and below the level of the fluid. When it is especially desired to affect secretion, the writer makes the application with the patient recumbent, alternately supine and prone, that the cardiac portion, in which the chief secreting structure resides, may particularly come under the current influence.

It is perhaps needless to urge that the diet can scarcely be too carefully regulated in gastritis. The secretory glands are always affected, and in pronounced cases their function is profoundly disturbed, while the absorbent and motor powers are likewise deranged, as has already been stated. Stomach digestion, in any save the mildest cases, cannot be efficiently performed except with artificial aid, and with this rendered, as it always should be to preserve adequate bodily nutrition, the food must still be of the simplest and most digestible character. When digestion is much disordered and nutrition fails, the patient not responding well to a regulated general diet, milk may be tried exclusively for a short time, should it agree, in order to place the inflamed organ in a state of as complete rest as possible. It cannot, however, form the sole food for any length of time without nutrition suffering, for, as Ewald[1] intimates, a purely milk diet is equivalent to slow starvation. It is only indicated for short periods when subacute catarrhal conditions complicate the chronic inflammation. It should be given skimmed, warmed, and with an alkali added to assist in its digestion—sodium bicarbonate preferably to lime-water, since the latter is but feebly antacid. Roberts recommends the addition to each glass of a powder consisting of 10 grains each of sodium bicarbonate and common salt, and 5 grains of light magnesia, and also suggests that one-third hot water added to plain milk will aid in its digestion. In the gastric catarrh of alcoholics, when thirst is excessive, he has seen excellent results from the use of equal parts of milk and Apollinaris water. Constipation accompanying milk diet is readily relieved by use of Carlsbad (or similar) salts. Peptonized milk or peptonized milk-gruel may replace milk should the latter prepared as indicated not agree. Other peptonized foods are also necessary for short periods to relieve the overtaxed organ, or for more lengthened ones in conditions of atrophy of the gastric tubules, when the administration of the digestive ferments will not render the simplest aliment well borne. Of the peptonized preparations, those of beef are especially indicated in advanced mucous catarrh and in atrophy, owing to the prolonged imperfect digestion of albuminoids tending to result in nutritional changes which may lead to the development of tuberculosis or of fatal anæmias. The best preparation of peptonized beef, and one which the writer has recently used largely in various combinations, since it incomparably outranks all in nutritive value, is that sold under the

[1] *Op. cit.*, 303.

name of "Mosquera's beef-meal." This preparation consists of lean beef digested while fresh with the juice of the pineapple until most of the proteid tissue is transformed into proteoses and peptones, and then desiccated. Ninety per cent. of this beef-meal is nutriment, of which 77 per cent. is albuminoid matter and 13 per cent. fat,[1] according to the analysis of Chittenden. Of the 77 per cent. of albuminoid matter, 29.43 per cent. is in the form of soluble digestive products, albumoses, and peptones, ready for immediate assimilation. Chittenden believes that the insoluble albuminoid matter (48 per cent.) is, through the action of the digestant, so disintegrated that it is apparently more readily soluble in the natural digestive juices and more available for nutritive purposes than ordinary muscle-tissue, although it has not been converted into proteoses or peptones. This preparation, which is unparalleled as a nutrient, is without the disagreeable smell or taste attached to peptones digested with pepsin or trypsin. Though quite insipid in its plain state, it can be made palatable enough by flavoring with salt or, preferably, by combining it with other foods, especially with pleasant-tasted meat-soups or broths. The writer is now using largely a very agreeable, tasteful mixture of it with equal parts of sugar and cacao. This should be taken with hot milk, and makes a palatable and nutritious beverage. The soluble digested portions of beef-meal, evaporated to a pasty consistence, are also prepared separately under the name of "Mosquera's beef-jelly." This has the appearance of an ordinary beef-extract, has an agreeable odor and a pleasant flavor, and when added to boiling water makes a clear bouillon infinitely more nutritious than any ordinary extract of beef. Beef-jelly is to be preferred to the uncombined meal, as it is much easier taken and better borne by the stomach; patients, too, are less apt to weary of it. It, like the meal, may be added to ordinary consommé, chicken, or mutton broth. The yelk of an egg, made into a paste with a teaspoonful of the jelly and dissolved in a cup of boiling water, increases its nutritiousness and palatability.

But patients soon tire of artificially digested foods, and, however well they may be borne at first and how much relished, the palate and stomach are soon apt to weary of them and rebel. They are only constantly indicated in advanced mucous catarrh and atrophy, when hydrochloric acid and pepsin are persistently absent from the gastric secretion. They should then be frequently varied, and perhaps occasionally alternated with very easily digested albuminoid aliment, given along with pancreatin and sodium bicarbonate. When more solid food is indicated, it must be, of course, most thoroughly masti-

[1] A detailed description of this preparation, and an analysis of comparative values of this and other beef-products, are made the subject of an interesting paper by Chittenden in the *Medical News*, June 27, 1891.

cated and insalivated to aid the saccharification of any starch present, to furnish a stimulant to gastric secretion through the act of mastication and the influence of swallow-saliva, and finally to so prepare the bolus that the work of solution in the stomach will be at a minimum. Much food should not be eaten at one time, and if digestion is much delayed a sufficient interval must elapse between meals to permit the stomach to empty itself. When solid food can be taken, albuminoids are preferable to carbohydrates, since, though perhaps less easily disposed of without artificial digestants, they are less apt to cause fermentative changes than a farinaceous dietary, so largely composed as it is of starches and sugar, which readily undergo decomposition in the stomach, with the production of irritating organic acids. Eggs, soft-boiled, their albumin becoming opaque, though remaining semifluid; short-fibred, tender meat free from fat; boiled mutton or roasted tender beef; broiled tenderloin of steak,—may be permitted, provided they are digested without discomfort with the assistance of hydrochloric acid, and, if necessary, pepsin. Meat should not be prepared for the table until rigor mortis has passed off, it then being more tender and digestible. Leube admits into the dietary fish and boiled veal free from fat. The tender part of oysters raw or lightly broiled or panned may be taken, as may also well-made stale white bread, fresh young peas, carrots, asparagus, and occasionally rice well boiled, and a small part of very mealy potato. In mild cases of gastritis, in which fermentative processes do not readily occur, uncooked, and especially cooked, fats are wholly inadmissible, since they mechanically delay gastric digestion by impeding penetration of the gastric juice, forming a coating about otherwise soluble ingesta, and increase the unhealthy condition of the mucous membrane by the irritating influence of fatty acids developed from them. The only exception that can be made is butter in small quantity spread very lightly upon bread, and occasionally, when it seems to agree, a little cream used as a sauce.

Condiments, except salt, are to be avoided. Broths or soups made from meat-extracts, and beef-tea, must be partaken of sparingly, if at all, at the time other food is eaten, because of the neutralizing effect of the salts they contain on the gastric acid, thus impeding digestion very decidedly.[1] They may, however, be taken with benefit in small quantity at the beginning of a meal, before other food is eaten, for then the hot solution would be most readily absorbed from the mucous membrane, in passing through which stimulation of its secretory and muscular activity could occur, resulting in increased vigor of digestion.

[1] Tea has a powerful inhibitory effect on starch digestion, which may be overcome somewhat by its being taken weak, used sparingly, and only after a meal; it is rendered entirely harmless by the addition of a pinch of sodium bicarbonate to the teapot on making the infusion—about 2 per cent. (Roberts, *op. cit.*, p. 123).

In this connection it may be mentioned that Schiff[1] supposes that substances which he styles peptogens—meat extracts (or soup), solutions of dextrin, infusion of green peas, bread (which contains dextrin), gelatin, and peptone—when taken on the fasting stomach and after being absorbed into the blood possess the power of stimulating the secretions of gastric juice, and that this effect is also produced by them when ingested into the blood, cellular tissue, or rectum. Cold drinks should be avoided, all fluids being taken, as suggested by Ewald, with the "edge off." If tea and coffee are used, they must be drunk very weak and without cream or sugar, and after rather than with the meal.[2] To assist the digestion of unpeptonized albuminoid aliment, hydrochloric acid should be given when the former causes the slightest discomfort, unless complete atrophy of the gastric tubules is suspected, shown by entire and persistent absence of pepsin-hydrochloric acid and rennet-ferment in a person in whom nervous anacidity can be excluded.[3] In complete gastric atrophy it is useless, of course, to attempt to arouse to activity tubules the secretory function of which is permanently abolished: hydrochloric acid then is not indicated, since the benefit arising from its use as a supposed digestant seems to be as much due to its power to stimulate the transformation of pepsinogen into active pepsin as to act as a synergist to pepsin acid already formed.

As Boas[4] points out, an amount of this acid so great as to be impracticable of administration would be required as a digestant in case of its entire absence, because the greater portion would disappear in forming combinations with the albuminoids and salts present in the food, sufficient not remaining to appear as free acid. Boas therefore regards hydrochloric acid indicated, except as an antizymotic, only when the stomach-contents alone or on the addition of hydrochloric acid digest egg-albumin or fibrin energetically, and if a response occurs to the lab-zymogen test. If the digestion-test results negatively or weakly, and if the test for lab-zymogen shows much diminution, Boas uses hydrochloric acid merely as an antifermentative, his idea being that sufficient cannot be administered when its secretion is suppressed, or even much diminished, to be of practical benefit as a digestant. With the latter supposition the writer cannot agree,

[1] *Leçons sur le Physiologie de la Digestion*, Paris, 1867, vol. ii.

[2] The caution is again necessary that we cannot rely alone on the negative response to Günzberg's and Boas's tests as to the absence of hydrochloric acid. The $CaCO_3$ test should be applied.

[3] The utmost caution is necessary in differentiating these two affections, the prognoses of which differ so widely. In the absence of other subjective symptoms leading to a separation, it is only the prolonged (for months) and persistent absence of hydrochloric acid which justifies the diagnosis of atrophy.

[4] *Op. cit.*, p. 249.

believing that when complete atrophy does not exist and secretion of pepsin and acid occurs, yet not enough of the latter to render the pepsin active, the timely administration of hydrochloric acid in full doses, 20 minims of the dilute acid largely diluted, and repeated at intervals of twenty minutes to half an hour until one or two drachms have been taken, will not only satisfy the yet uncombined albuminoids and salts present in the food, but will leave sufficient free acid for efficient digestion.

The indications for hydrochloric acid in chronic gastritis may be thus briefly formulated: It should be employed in all cases in which digestible albuminoid food causes discomfort, and in which the result of the chemical tests shows evidence of some secretory activity on the part of the tubules. It is preferably administered in doses of from 10 to 30 drops of the official dilute acid, to be taken through a glass tube in sufficient water to cover the sharp taste, the initial dose to be taken half an hour after meals, and repeated at intervals of half an hour until two, three, or four doses are taken, the number depending upon the readiness with which the symptoms are controlled. The initial dose should always be delayed until a short period after the meal in which amylaceous food forms a part, in order that the saccharification of the latter—which, initiated in the mouth, continues in the stomach until the acidity of its contents becomes raised—be not interfered with in the early part of gastric digestion. The acid may be combined with glycerin, and, if anæmia is present, with the official liquor acidi arseniosi, which is a decided synergist to pepsin-acid digestion.

Pepsin, an enzyme that a host of medical purveyors throughout this country are vieing with each other in strenuous efforts to produce in such a state of purity that its digestive activity may equal thousands of its own weight, indicating, therefore, decided demand for its employment, and hence its great utility (?), is very frequently unnecessarily prescribed in apeptic conditions. This fact, however, is not generally understood, and with an entirely erroneous notion as to the indications for its use pepsin is far oftener ordered than is hydrochloric acid, and frequently not only without combination with acid, but it is actually prescribed with an alkali,[1] such as sodium bicarbonate, the influence of which would be to destroy the activity of the ferment thus administered and diminish its natural production by its neutralizing effect on hydrochloric acid. Though the writer believes that this wholesale prescribing of pepsin is unnecessary, he does not take the extreme view of Boas,[2] a

[1] A combination only indicated in those very rare cases of stomach neurosis in which hypersecretion or hyperacidity occurs, due to much increased production of hydrochloric acid, with diminished formation of pepsin—a condition never present in gastritis.

[2] *Op. cit.*, p. 254. Boas holds that pepsin is practically useless in conditions in

corollary to that of his already cited as to the indications of hydrochloric acid, that it cannot be of service in any condition of disturbed digestion except in those rare cases (mentioned in a preceding foot-note of gastric neuroses in which there is an untoward relation between the secretion of hydrochloric acid and pepsin. The writer believes—and clinical experience supports his contention—that conditions exist in diminished secretory activity in which pepsinogen as well as acid formation occasionally is lowered, though never to an equal extent, since the pepsin cells are far more numerous and more widely distributed than the acid-producing cells. For he has occasionally encountered cases in which symptoms of indigestion due to diminished secretion of gastric juice were only ameliorated by hydrochloric acid, and did not disappear until pepsin was conjointly prescribed. Such positive evidence is of course of more value than any theoretical considerations to the contrary. Another fact must also be borne in mind in considering the indications for pepsin: that, unlike the case with hydrochloric acid, with which digestion is most active when present in about 0.2 per cent., and is retarded when much below or above this amount, the speed of digestion is in direct proportion to the amount of pepsin present, without any limit, according to Roberts, so that no harm can result from a reasonable excess. But in view of the fact that pepsin, unlike hydrochloric acid, possesses great continuous activity, acting by mere presence, that this is not so persistently diminished from the gastric secretion as is hydrochloric acid, and that the albumin of the latter greatly stimulates pepsin-formation, it may be seen that at least in most cases it is more frequently used than is necessary. When pepsin is thought to be indicated, it should be prescribed in one or more doses of 5 grains. It may be conveniently combined with dilute hydrochloric acid, glycerin and orange-flower water (or other pleasant excipients) being added as diluents.

When the addition of farinaceous aliment to the dietary seems essential, decidedly beneficial results are often obtained by the use of an active pancreatic extract,[1] preferably administered in solution immediately before or during the first part of the meal. This assists in the

which the formation is diminished or absent if secretion of hydrochloric acid is likewise lessened or in abeyance (as always occurs in gastritis), because the appearance of pepsin (the transformation of the proenzyme into pepsin) depends upon the presence of the hydrochloric acid. In the former condition hydrochloric acid is alone indicated to induce formation of sufficient pepsin for digestive purposes, and in the latter, as pepsin is inoperative without an acid, it would be useless to employ it. As has already been set forth, he believes that to render it efficient would necessitate the coincident administration of hydrochloric acid in doses too large to be well borne.

[1] As all amylolic ferments are more active in neutral media, the combination of soda with pancreatin is unnecessary when it is given for the purpose of assisting starch digestion. Alkalies should not be used immediately before or during meals in gastric catarrh, for obvious reasons.

complete saccharification of starch, and also, depending upon the amount of trypsin it contains, aids slightly in the digestion of proteids, largely preventing the development of irritating organic acids, of such frequent occurrence through fermentation of starches when the latter are taken without the employment of an artificial digestant. In conditions of complete anacidity, when the use of hydrochloric acid and pepsin could not be beneficial, and in advanced subacidity, when the results of its employment do not justify its continuance, pancreatin may be prescribed after meals with benefit, in combination with soda if the development of sufficient organic acid to impede its action is feared.

Gastralgic attacks, more frequently symptomatic of nervous dyspepsia, chlorosis, or gastric ulcer than of the affection under consideration, are rarely very severe in gastric catarrh, and when they occur are usually due to peripheral irritation of the stomach-nerves by undigested, decomposing food. Their management necessitates, as far as possible, removal of the cause, the administration of morphine, hypodermically or by the mouth, during the attack, if the intensity of the pain demands it. Mustard to the epigastrium should be used, and for the mild attacks or during the intervals of the more severe ones, if the latter frequently occur, a combination of cannabis indica, belladonna, and cocaine is of the greatest service. The use of bismuth subnitrate and zinc oxide is also very beneficial. If these drugs, or others that may be deemed indicated, are given in solution, a few drops of dilute hydrocyanic acid may be added to each dose, and cherry-laurel water used as the excipient. Where a neuralgic element seems especially to underlie the gastralgia, the daily application of galvanism is of the greatest utility, the anode upon the tender epigastrium and the cathode in the left hypochondrium or upon the lower dorsal spines, or the anode may be applied directly to the interior of the stomach—a procedure rarely necessary for the relief of the gastralgia of chronic gastritis.

The state of the bowels must receive the most careful attention in gastric catarrh. The action of lavage in promoting their regularity has already received notice, as has the beneficial effect arising from the coincident administration of saline laxatives, such as Carlsbad water or other forms of purgative salts. Salines are of the greatest benefit, preceded by an occasional dose of a mercurial (calomel or blue mass), in relieving the engorged condition of the portal viscera frequently accompanying the chronic gastritis, heart, and liver disease of drunkards, and frequently present also in mucous gastritis, whatever the cause. A caution is necessary that salines, Carlsbad water, and especially Carlsbad crystalline salt, consist almost entirely of Glauber salt, the effect of which is exerted chiefly on the liver and intestines. These or other salines must not be given in too full doses or too continuously, otherwise the secretory function of the stomach will be eventually lowered rather

than improved. Their use is indicated for briefer periods than the salines—not over two to four weeks, in small doses daily or once in two days, one hour before breakfast. The purgative influence of all laxative waters and salt solutions is most decided when the solution is taken warm. Should a salt, instead of a natural water, be used, if resorted to daily, sufficient only should be taken ($\frac{1}{2}$ to 1 tea-spoonful to $\frac{1}{2}$ pint) to ensure one free evacuation. If Carlsbad water is used, $\frac{1}{2}$ to $\frac{3}{4}$ pint is all that is necessary. When the more purgative waters can be dispensed with, if the regularity of the bowels is not maintained by short courses of the saline waters, by lavage, or by artificial digestants, very small doses of the vegetable aperients may be used daily, such as cascara sagrada, aloes (preferably in the form of aloin), rhubarb, and occasionally podophyllin. The last is especially indicated when both an hepatic stimulant and a cholagogue are desired, and it may be given alone or combined with extract of nux vomica or strychnine sulphate, or a small amount of belladonna or hyoscyamus may be added to obviate griping and to assist the laxative action through its influence over peristalsis. The form of laxative should be frequently varied, as the effect decidedly diminishes with constant use, especially if too large doses are employed; which should always be avoided, since the object in the administration of these laxatives—especially cascara sagrada, which is without a superior in this direction if properly handled—is to induce regularity of the bowels through tonic effect on their muscular coat. The natural vegetable aperients—such fruits as tamarinds, prunes, and figs—may be used in moderation should they agree. Fermentative processes are both prevented and best controlled by careful regulation of the diet, the exclusion of carbohydrates, and the use of systematic daily lavage, preferably without antiseptics, which, though promptly removed by the tube, may tend to cause irritation during their brief stay in the stomach. Lavage with mild, warm, alkaline solutions for the purpose of dissolving and removing mucus, one hour before breakfast, repeated in pronounced cases, if necessary, one hour before the evening meal, or, instead, before retiring, should be continued so long as the symptoms demand it and benefit results from its employment. As amelioration occurs it will be necessary less and less often. When the symptoms soon after a meal indicate decided decomposition which cannot be controlled by the administration of hydrochloric acid, recourse should be had without delay to the tube to empty and clean the stomach. Food-elements should not be allowed to remain and decompose if they can be removed. The catarrhal process is not only much aggravated thereby, but the passage of the products of decomposition into the duodenum is likely to cause a catarrhal condition of this part, resulting in intestinal meteorism, diarrhœa, and more or less icterus, owing to the implication of the ductus communis in the process.

As fermentation in the stomach occurs through diminution of the proper gastric secretion, hydrochloric acid, which strikes at the cause, is the best antifermentative. It should be given after meals, in repeated doses at short intervals, or, as Boas prefers, on an empty stomach. Sodium bicarbonate or other alkalies should be given sparingly, if at all, after meals, for the purpose of correcting the pyrosis of chronic gastritis, which is invariably set up because of diminution in the secretion of hydrochloric acid, since, as Henry justly points out, though the lactic acid, the usual cause of pyrosis, is neutralized and the discomfort lessened for a time, the latter soon returns with redoubled vigor, the increased alkalinity favoring still more the growth of the lactic-acid organism. If a recourse to antiseptics seems desirable to correct gastric and intestinal flatulency, hydronaphthol, bismuth salicylate, and salol are the most efficient remedies. Hydronaphthol, which the writer has used for a number of years in various forms of intestinal disorders originating meteorism, in doses of from 2 to 5 grains, has been of extraordinary benefit in his hands. It may be taken in capsule, ingested with considerable water. Bismuth salicylate, which he has used less, has given satisfactory results, especially when combined with powdered willow charcoal. The dose is 5 grains of the former to 10, 20, or more of the latter. Salol, in 5- to 10-grain doses, is especially serviceable in intestinal flatulency, though I have not found it so efficient as hydronaphthol. Both hydronaphthol and bismuth salicylate, like most agents of this class, have a somewhat retarding effect on gastric digestion, and therefore should not be used too soon after a meal nor repeated too frequently. Thymol is an excellent antifermentative in doses of $\frac{1}{2}$ grain to $1\frac{1}{2}$ grains. It may be prescribed triturated with a very little white sugar, or preferably in a small quantity of alcohol, in which it is soluble.

The presence of anæmia is diminished by hydrochloric acid, but demands also the employment of mild ferruginous preparations, such as iron peptonate, mentioned under Gastric Ulcer, or some of the combinations of iron with the vegetable acids. Arsenic may also be used, preferably in the form of the acid solution, the effect of which is more certain than Fowler's solution, in 2- to 5-drop doses after meals.

Finally, the general hygiene of the patient demands the most careful attention. His life should be spent in the fresh air, and as much muscular exercise taken as the strength will permit. Exercise must not be taken near a meal-time, and should never be persisted in to the point of great fatigue, lest the digestive functions thus be indirectly disturbed. It should consist in the use of the muscles generally, but especially those of the abdomen. Walking and horseback riding are of service. Ewald recommends rowing with a sliding seat. The function of the skin should be maintained by frequent baths, and douches to the abdomen and epigastrium

are serviceable as exciters of peristole and as reflex stimulators of secretion. In all cases of gastritis except the simpler variety, which usually improves rapidly on the treatment indicated, an examination into the gastric functions, especially the secretory, should, if possible, be made at intervals of a month or six weeks, so that if decided subjective benefit is not noticeable, the plan of therapy pursued, if not productive of some perceptible objective results, may be modified or changed, since no time is to be lost in the treatment of the pronounced forms, which, apart from the danger of the development of obstructive or atonic dilatation of the stomach, have a tendency to run into incurable atrophy of the gastric tubules.

Little remains to be said of the management of gastric atrophy, the therapy of which can be but symptomatic. The gastric motility and absorbing powers are always much diminished, and dilatation is apt to exist. Efforts must be made to improve peristole and diminish dilatation by the use of full doses of strychnine, by epigastric and abdominal massage, galvanism, and faradism. The ingestion of fluids should be avoided. Aliment must be predigested, or, when easy of solution, be given with an active pancreatic preparation. In cases with dilatation and pronounced motor insufficiency, with or without pyloric stenosis, gastro-enterostomy offers the only chance against gradual starvation. So long, however, as considerable motor insufficiency and dilatation do not exist and the pylorus remains patulous, a fair nutrition may be maintained for some time by the above means or even through the aid of duodenal digestion alone. As, according to Boas, massage of the right hypochondrium toward the median line and in the region of the right and left lobe of the liver tends to press the intestinal juices from the duodenum through the pylorus, it has been suggested that this procedure be systematically instituted in cases of atrophy, that gastric digestion be thus carried on by aid of the patient's own pancreatic and biliary secretions. This ingenious idea is at least worthy of trial.

SIMPLE ULCER OF THE STOMACH.

It has long been believed that the most prominent factor in the development of simple ulcer of the stomach is a local disturbance in the normal balance existing between the acidity of the gastric secretion and the alkalinity of the stomach-walls, permitting the solvent action of the former on a portion of the mucosa, rendered vulnerable through a variety of causes, these causes originating, as was thought by Virchow and others, in impairment or interference of the circulation in a limited

area of the stomach-wall due to vascular obstruction, thus inducing diminished alkalescence. Though occlusion of the vessels supplying a circumscribed part of the stomach may undoubtedly originate an ulcer, this view, so long dominant through the powerful support of Virchow, has not now many adherents, since such alterations and the causes that induce them are rarely found post-mortem to be associated with ulcer. The more likely cause of simple ulcer of the stomach is that which supposes a disturbed balance between acidity of the gastric secretion and alkalinity of the stomach-walls, due to actual increase of the former, which causes erosion of the part the site of an injury to the mucous membrane—a small abrasion which may have been produced by the ingestion of an irritant, mechanical, thermal, or chemical. This view, which has recently found many supporters for the reason mentioned below, is essentially that of Leube.[1] It is supported by the experiments of Daettwyler[2] on dogs, who produced ulcer of the stomach in the latter simply by the application of chemical, mechanical, and thermal irritants to the inner walls of the stomach. A slight solution of continuity resulting through the action of an ingested irritant might in the predisposed readily develop into an ulcer by the corrosive action of a highly acid gastric juice, perhaps assisted, as suggested by Leube, by the stimulating effect of the latter on the denuded blood-vessels, inducing in such cases, according to Klebs, narrowing of their calibre and local anæmia, which in its turn would cause lessened alkalescence.

Recent observations seem to point to the fact that neurotic disturbances of digestion, with heightened excitability of the secretory nerves, inducing hyperacidity or hypersecretion of the gastric juice, whether idiopathic or secondary to other neuroses, such as hysteria, neurasthenia, and melancholia, are very frequently present in the class of subjects in which ulcer most frequently develops, such as young chlorotic females;[3] and though the researches of Riegel,[4] which led him to the conclusion that hyperacidity may be regarded both as a constant accompaniment of simple ulcer of the stomach and a predisposing cause, have not received entire confirmation at the hands of subsequent investigators, they have at least not suffered sufficient modification to render his conclusion re-

[1] Leube, *op. cit.*, p. 206. [2] Quincke, *Deutsche med. Woch.*, No. 6, p. 79, 1882.

[3] Hyperacidity exists so commonly in those in whom ulcer most often occurs, and has been found so constantly with it, that when it is considered how easily excessively acid gastric juice might lead to ulcer, other conditions, such as anæmia and a slight abrasion of the mucosa caused by an ingested irritant, being favorable, I think it may be looked upon as a determining factor in most cases. When hyperacidity is not found its absence is probably due to the existence of a chronic gastritis, which frequently complicates ulcer, the tendency of which must be to lower secretory activity.

[4] Riegel (*Zeitschr. f. klin. Med.*, 1887, xii. p. 434) showed, as a result of 382 analyses of the stomach-contents in 42 cases of ulcer of the stomach, that free hydrochloric acid is almost invariably increased, and frequently decidedly so (the percentages 0.4 and 0.5 being common in his cases), as against the normal 0.1 to 0.2 per cent.

garding the influence of increased secretion of hydrochloric acid on the development of ulcer invalid. For this condition of heightened secretory activity is too common in ulcer not to be regarded as an important determining factor. Notwithstanding the observations of Cahn, Mehring, and others, that hyperacidity is not constantly associated with ulcer, Riegel's conclusions, based on numerous examinations in many cases, seem sufficiently well founded to be regarded at least as highly significant and worthy of most careful consideration from the standpoint of prophylaxis. For, apart from the evil influence of hyperacidity (with or without hypersecretion [1]) on the gastric saccharification of starch and on duodenal digestion, and apart from the fact that hypersecretion may ultimately cause atonic dilatation and gastric catarrh, the likelihood that ulcer may develop through the occurrence of a slight injury to the mucous membrane of the stomach in subjects with hyperacidity should lead to the institution of active measures to remove this condition in all such cases that come under observation. Especially would this be necessary were these the subject of anæmia. For, as is well known, ulcer is most common in the anæmic as a result, rather than as a cause, of the impoverished blood; which fact is significant in view of the experiments of Dactwyler, who found that when dogs were rendered anæmic by frequent bleeding gastric ulcer developed from much slighter irritants applied to the inner stomach-walls than when depletion was not practised, and that these ulcers healed more slowly.

Hyperacidity necessitates correction of the condition underlying it, and the administration of an alkali, both for the purpose of completely neutralizing acidity, thus obviating the danger of corrosion of the stomach-walls, and also to allay sensory and motor irritability, so frequently present in these cases as a result of the action of the excessively acid gastric secretion on the sensory nerves. The alkali must be given in full doses, about four hours after a meal, at the completion of gastric digestion, or even earlier should the discomfort caused by the hyperacidity be excessive, and again, perhaps, shortly before a meal, at the time first mentioned. The purpose is served not only of obviating the irritant effect of the excessively acid secretion on the gastric mucosa after the food has passed the pylorus, but also of preventing its inhibiting influence on the duodenal digestion of carbohydrates and fats, always imperfect in cases of hyperacidity. If the acidity is excessive, the alkali may be used shortly before a meal, thus permitting the partial stomach digestion of starches, impossible through the too early appearance of free hydrochloric acid. Any active alkali or alkaline earth not of too disagreeable taste may be used. The alkalies in common use are

[1] Hyperacidity often exists without hypersecretion, while the latter usually is accompanied by the former.

sodium bicarbonate, precipitated chalk, calcined magnesia, ammonio-magnesium phosphate, and magnesium carbonate, any one of which is efficient. Sodium bicarbonate is most often resorted to as a neutralizer of acidity. Apart from its disagreeable soapy taste, to which many object, especially when taken in the form of the otherwise convenient and efficient soda-mint tablet, its antacid potency is lower than any of the others mentioned, several of which, especially the ammonio-magnesium phosphate,[1] are to be preferred because of their tastelessness.[2]

As suggested by Roberts,[3] the alkalies are to be used preferably in the form of lozenge, which should be allowed to dissolve slowly in the mouth. A plentiful flow of alkaline saliva will be thus induced, which, gradually swallowed, acts both as an antacid and as a bland demulcent to the angry mucous membrane.[4]

Hyperacidity accompanying hypersecretion requires not only the frequently repeated use of alkalies, but also systematic lavage, either shortly before a meal or at the completion of its stomach digestion. Reichmann recommends the employment of silver nitrate in these cases, either in the form of a wash, 1 part to 500 or 1000, or $\frac{1}{2}$ grain to 1 grain in 10 drops of water and enclosed in a capsule. The diet must be dry and chiefly albuminous, to make use of the excessive secretion of gastric juice. A systematic use of antacids for a prolonged period in the manner indicated, combined with the employment of alkaline purgatives, the indications for which will be presently mentioned, will eventually, in most cases, lower secretory activity, especially if an effort is made to reach the cause of the disturbance. Alkalies must, however, be used with discretion, and they should never be taken in sufficient

[1] According to Boas, *op. cit.*, p. 250.

[2] The saturating power of magnesia compared with sodium bicarbonate is as 4 to 1; that of ammonio-magnesium phosphate, 2 to 1; magnesium carbonate, creta precipitata, slightly less than 2 to 1. A full antacid dose of sodium bicarbonate is 10 to 20 grains; that of the others in proportionate amounts. (See Boas, *op. cit.*, p. 250; Roberts, *op. cit.*, p. 255.)

[3] An antacid lozenge made after his formula is now sold in the shops; it is much preferable to the soda-mint troche. It contains $3\frac{1}{2}$ grains magnesium carbonate and $2\frac{1}{2}$ grains of chalk, these quantities equalling in saturating power 10 grains of sodium bicarbonate. Roberts recommends that 1 grain of common salt be added to the tablet to increase salivary flow.

[4] Roberts, *op. cit.*, p. 251. Roberts states that he has ascertained that a direct relationship exists between the acidity of the gastric juice and the alkalinity of the saliva, so that during the prevalence of surplus acid in the stomach an increased flow of highly alkaline saliva occurs, which is involuntarily swallowed and becomes the natural antacid of the stomach. This increased salivation he regards as a conservatism of nature to be encouraged by the use of any agent promoting salivary flow. Lozenges do this, and especially simple gum lozenges. With these gum lozenges, because of their stimulating effect on the salivary glands and the soothing influence of the swallowed gum on the irritated mucosa, he has obtained distinctly more curative results than by the use of alkalies, which he resorts to only if the surplus acid is great and the torment severe.

doses to completely neutralize acidity during digestion, lest a catarrhal gastritis with subacidity result, more difficult of removal than the preceding heightened physiological condition. Care must be taken to prevent the development of anæmia. The diet in these cases, apart from its influence on secretion, must be bland and unirritating; indigestible substances likely to irritate the stomach mechanically, spices, acid food, or drinks of very high or low temperature, are to be avoided.

The one essential indication in the therapy of gastric ulcer, in comparison with which the use of drugs formerly supposed to exert a more or less specific influence is as naught, and with which their employment is unnecessary, is to lessen the functioning of the stomach, as far as it is practicable with the maintenance of a fair nutrition, by a diet that will stimulate it to activity as little as possible, and by the exclusive use of rectal feeding for short periods when there are present such symptoms as hæmorrhage, severe and continuous pain, and vomiting, suggesting the advancement of the ulcerative process. From the first, and continuously so long as the symptoms indicate that complete cicatrization has not occurred, the diet should consist of partially or wholly predigested concentrated aliment, the solution and transfer of which into the duodenum will disturb the stomach mechanically and chemically as little as possible. Concentrated aliment that affords considerable nutriment in small bulk is especially indicated, both for the purpose of diminishing the work of the stomach and for the reason mentioned by Yeo,[1] that this viscus be maintained in a contracted state, so that the margins of the ulcer be thus constantly relaxed. By this means its extent will be lessened and its healing favored. Rest in bed in all cases in which the symptoms are well marked and nutrition is depressed is also essential; with it less nourishment is required, that taken is better borne, and cicatrization is more readily favored than if the patient is permitted to be about. The food best suited for cases of gastric ulcer, and which, properly prepared, usually can be made to agree despite supposed idiosyncrasy, is milk, the diet which, since first recommended by Cruveilhier, has been used successfully in thousands of cases.[2] It should be taken in small quantities (from 4 to 6 ounces[3]), skimmed or not, boiled or raw, as it agrees, at intervals of two or three hours, and should preferably be rendered alkaline if it is not peptonized; otherwise the large tough coagula occurring in its digestion in its natural condition in the highly acid stomach will surely disagree. Saccharate of lime contains five times as much lime as does lime-water, and may well replace the latter. Precipitated magnesium

[1] Yeo, *Food in Health and Disease*, p. 389.

[2] Leube, *op. cit.*, p. 219.

[3] Or less and oftener if the stomach be very irritable. About three pints must be taken in the twenty-four hours if milk alone be used.

hydrate (milk of magnesia), recommended by Smith as an antacid in ulcer, should also be very efficient.

Peptonized milk, and preferably peptonized milk-gruel, are especially indicated where decided gastric irritability exists and severe paroxysmal pain occurs after food; they can well replace simple alkalinized milk at all times. In their preparation peptonization should not be carried beyond the point of faint bitterness;[1] if the latter taste is objectionable, as it usually is,[2] when the case is progressing favorably their use may be varied with other light aliment, that the palate be not satiated by sameness, though if peptonized milk-gruel is not much wearied of, and the patient seems to thrive on it, it had better be continued as long as possible. Indeed, the same may be said of any form of diet that agrees. Peptonized milk-gruel, however, seems to be of especial value in gastric ulcer. Roberts commends it in the highest terms. He regards it especially indicated in cases associated with epigastric pain. In one case which he details gastric irritation was such that the simplest nourishment given in smallest quantity was immediately rejected. Peptonized milk-gruel was tolerated at once; vomiting occurred only once or twice during the first two days of the treatment, and then ceased, as did likewise epigastric pain. The patient took daily 2 or 3 quarts of the peptonized milk-gruel for a period of six weeks, no other form of nourishment being used; steady recovery of flesh and strength occurred. Ice-cream has recently been suggested, and seemingly with reason, as an efficient food in gastric ulcer. Hershey reports three cases in which the simplest aliment by the mouth, such as alkalinized as well as peptonized milk, was not retained, and in one of which predigested enemata were likewise rejected. In all, on other food being discontinued and ice-cream permitted, digestive disturbances ameliorated and rapid improvement occurred. The employment of this singular diet was suggested by its influence on the first of the cases seen in the clinic of Dr. DaCosta. This patient had herself resorted to ice-cream on discovering that no disturbance of the stomach occurred through its ingestion. Its continuance for this reason was advised by Professor DaCosta, with the happiest effects, similar results being obtained in the others. These results justify its further trial in ulcer.

Ewald recommends soups made of milk and various forms of flour,

[1] Yeo (*loc. cit.*) advises the addition to each cup of milk of a powder containing 10 grains each of sodium bicarbonate and common salt, 5 grains of light magnesia, and 1 table-spoonful of water.

[2] The addition of Vichy, soda, Apollinaris, and other carbonated waters is recommended to overcome the bitterness, which, however, is hardly perceptible in the gruel. Aërated waters must, however, be used sparingly, if at all, in ulcer, because of the irritant effect of the free CO_2 on the ulcerated surface. A small quantity of coffee entirely masks the bitter taste, according to Smith (*Med. News*, May 17, 1890).

the latter added, as are alkalies, to induce finer coagulation of the casein. The addition of a small quantity of one of the predigested and nutritious infants' foods, such as Mellin's, Carnrick's, or Nestlé's, has a similar effect. Potato purée (made with milk) usually agrees well, especially if a good preparation of malt is taken with it.

When milk is wearied of, though prepared so as to be least objectionable, and the patient's condition does not improve,[1] as may happen through adequate nutrition not being maintained with it, a predigested beef-solution, similar to that devised by Rosenthal and Leube,[2] should be resorted to, or may, indeed, be used from the first with the best results. Leube's experience in the treatment of gastric ulcer is extensive and highly successful, and, though he places a high value on milk in this ailment, his results have been far more gratifying with this meat-preparation. Leube regards the beef-solution as especially valuable, as its constituents are ready for absorption without any particular action of the gastric juice, so that secretion of the latter is little stimulated. He believes that this preparation is either directly absorbed from the stomach or passes unchanged into the duodenum. As it is without irritant quality and makes but slight demand on the digestive functions, the diseased viscus is rested, and the ulcerated surface, freed from constant irritation, is placed in a condition favorable to cicatrization. Leube's experience is that with it rectal feeding is usually unnecessary; after a few days' use pain and vomiting, if present, usually cease, and the healing advances so rapidly that at the expiration of two or three weeks the patient may return with impunity to a more solid diet.[3]

Leube gives this beef-preparation in either unsalted or very slightly salted broth, and an amount corresponding to half a pound of beef is taken in the twenty-four hours. Unfortunately, patients are apt to acquire such a disgust for it that they often cannot be persuaded to continue it. It possesses no advantages over other predigested beef-foods, and indeed is, theoretically at least, less valuable than some—notably Mosquera's beef-meal and beef-peptone jelly, previously re-

[1] Nutritive enemata may be required to supplement the use of peptonized milk by the mouth when the latter only can be taken and in small quantity.

[2] This is prepared by evaporating beef and dilute hydrochloric acid at a high temperature in air-tight vessels, which leads to the emulsification of the meat and its partial digestion: 1000 grammes of finely-minced lean beef, 1000 centigrammes of water, and 20 centigrammes of pure hydrochloric acid are placed in a porcelain vessel, and this in a closed Papin's digester, and boiled for ten to fifteen hours. The resulting mass is then rubbed into a paste in a mortar, again boiled in the closed digester for sixteen to twenty hours, and finally neutralized with sodium bicarbonate and evaporated to a syrupy consistence. This preparation is made by Rudisch of New York City. Though peptones are said by Leube to be formed by this process, it is unlikely that digestion proceeds beyond the acid-albumin, or at most the first propeptone, stage.

[3] Leube, *op. cit.*, p. 223.

ferred to, which represents, according to the analysis of Ludwig of Vienna, over 53 per cent. of soluble albuminoids, which have been almost entirely converted into peptones, and the whole containing but 3 per cent. of insoluble matter. Preparations of this sort, when a concentrated peptonized soluble meat-food is desired, are to be preferred to one only partly digested by hydrochloric acid. With the beef-meal I have had no experience in ulcer. It contains considerable insoluble albuminoids but slightly if at all digested. This insoluble portion, though probably readily converted into peptone in the stomach, according to Chittenden, might irritate the ulcerated surface if it were not. Mosquera's beef-jelly may be dissolved in boiling water, or preferably added to consommé; a yelk of an egg may also occasionally be given with it prepared in the manner detailed in the dietary of Chronic Gastritis. Though the beef-jelly should be added to boiling water or to broth at or near the boiling-point, it, as with other foods in gastric ulcer, must not be taken very hot.

It is of the highest importance that the diet be thus restricted for several weeks, until continued amelioration in or absence of such symptoms as severe pain, gastralgic or inflammatory epigastric tenderness, and vomiting indicates that cicatrization of the ulcer is in progress. Then in all except the chronic cases a more varied alimentation may be cautiously permitted, the patient being especially admonished as to the danger of reawakening the ulcerating process by the slightest lapse from the diet prescribed, the utmost circumspection on his part being enjoined for months after all symptoms of ulcer have disappeared. Care should be observed not only as regards quality, but also as to the quantity taken, no more being allowed than will satisfy the physiological needs of the body. An egg may be allowed daily lightly boiled or poached, but not raw, since raw egg-albumin is digested with difficulty both in the stomach and duodenum.[1] With the boiled or poached egg, crumbs from the interior of stale bread, flavored with a very little salt, may be eaten, and meat-broths, such as chicken and mutton-broths, if they have not been before used, may now be prepared with yelk of egg to render them more nourishing. Purées of vegetables, milk-puddings, custards, the lean of tender boiled mutton or young chicken, the scraped tenderloin of steak lightly broiled with

[1] The indigestibility of raw egg-albumin is shown by an interesting experiment of Roberts. He employs a solution of the white of 1 raw egg to 9 volumes of water. This, when heated in the water-bath, does not coagulate nor change in appearance, though its behavior to the digestive ferment is distinctly altered. In the raw state this solution is attacked slowly by pepsin and hydrochloric acid, and not at all by pancreatic extract; but after cooking in the water-bath the albumin is rapidly and entirely digested by artificial gastric juice, and a moiety of it is rapidly digested by pancreatic extract.

a little butter,[1] boiled sweetbread (the thymus gland), boiled whitefish, and such other wholesome digestible articles of food as the judgment of the physician dictates, may be permitted in moderation. He cannot throw, within practicable limits, too great restrictions about the diet, nor advise too much caution for several months after all symptoms have disappeared, having in mind, however, the necessity of allowing sufficient nourishment to maintain adequate nutrition. Indigestible food of all sorts, especially that likely to irritate the stomach mechanically, such as bran bread and oatmeal, is to be avoided. Fatty substances, acids, highly-seasoned foods, and alcohol in any form must also be interdicted.

Rectal feeding is to be resorted to for periods of a few days or longer on the occurrence of hæmatemesis, when more or less continuous vomiting or severe paroxysmal pain after meals is not readily controlled by cautious mouth-feeding or by the remedies suggested. In all cases of ulcer, if the patient can be kept in bed and will submit to exclusive rectal feeding, the stomach remaining at absolute rest, cicatrization is likely to occur earlier with fewer untoward symptoms than if this method were not practised. Though, according to Bauer, it is impossible to nourish properly by the rectum, scarcely more than one-quarter of the nutriment necessary for subsistence being taken in this way, extensive clinical experience has shown that exclusive rectal feeding for periods of several weeks is practicable in ulcer and attended with the best results. If nutrient enemata are to be employed for any time, it is especially important that the substance used be as unirritating as possible. The rectum should be washed out with a warm-water enema once or twice daily shortly before introducing the food. The syringe for the administration of nutritive injections should have a long flexible nozzle, and the food be deposited high in the bowel, both to include a wide absorptive area and that it may be better retained.[2] The nozzle should be well oiled, and must be inserted gently, without force, and the food be very slowly thrown into the bowel. The patient may be encouraged to aid its retention as much as possible by resisting any desire to reject it. Not over 4 ounces is usually injected at a time, the frequency of repetition depending upon the amount and the character of the nourishment introduced. Intervals of from four to six hours are those usually adopted, when from 4 to 6 ounces are used. As regards the character of aliment best adapted for nutrient enemata, liquids are preferable to solids, such as suppositories, especially in ulcer,

[1] Welsh, Pepper's *System of Med.*, vol. ii. p. 329.

[2] According to Brunton (*Pharmacology and Therapeutics*, Lea Bros., 1885, p. 415), if a long flexible soft-rubber tube is used, introduced to the extent of ten inches, and the patient is propped so as to incline to the left side, the fluid may be passed into the sigmoid flexure or descending colon. A much larger quantity than four ounces can then be used and absorbed with little or no tendency to its rejection.

when the withholding of all fluids by the mouth is desirable. Soluble unpeptonized albumin would appear to undergo absorption almost as readily as that which is predigested, so that predigested aliment need not necessarily be used.

Ewald,[1] as a result of experimentation with enemata of commercial peptone and with eggs, found that unpeptonized eggs were as readily absorbed as commercial peptone, and peptonized eggs more readily. He prefers an enema consisting of two eggs beaten up with a tablespoonful of cold water, to which is added a little starch boiled with a half tea-cupful of a 20 per cent. solution of glucose. A wine-glassful of claret is added to this, and subsequently the egg solution, care being taken that the white of egg is not coagulated. A tea-spoonful of peptone may be added with advantage to this mixture, though Ewald does not regard this as absolutely essential.

If solutions of peptones alone are used, they should be sufficiently diluted not to irritate the bowel, otherwise they will not be readily retained. According to the experience of Smith,[2] the best rectal food is defibrinated blood in amounts of 3 ounces every fourth hour when no food is taken by the stomach. This, he states, undergoes prompt absorption, as is shown by the character of the dejecta during the treatment. These are of a normal color, and absolutely free from all appearances of blood. Smith uses rectal injections of defibrinated blood in all cases of hæmatemesis, continuing it in small quantities for two or three weeks after the stomach has resumed its functions. He knows of no remedy equally efficacious in overcoming the profound anæmia usually present. Leube prefers for nutrient enemata an emulsion of meat and pancreas. But pancreatic extracts, of which several very active preparations are now on the market, are much more convenient for use than the pancreas itself, and quite as efficient. The enema as suggested by Roberts may be prepared in the usual way with milk-gruel and beef-tea, and a dessert-spoonful of liquor pancreaticus added just prior to its administration.

Plain milk, or preferably peptonized milk and peptonized milk-gruel, are well adapted for nutrient enemata.[3]

The enemata should always be warmed before introduction. Sometimes the addition of a small quantity of opium, preferably the deodorized tincture or McMunn's elixir, to the enema renders it better borne.

[1] Ewald, *Therapeut. Monatsh.*, March and April, 1887.

[2] Smith, *loc. cit.*

[3] Roberts nourished a patient by this method with enemata of pancreatized milk-gruel exclusively, and very satisfactorily, for a period of nine weeks, until a post-pharyngeal abscess, which had occluded the œsophagus, ruptured. Donkin (*Lancet*, Sept. 27, 1890) reports ten cases of gastric ulcer successfully treated by enemata of plain milk, occasionally varied by clysters of beef-tea. Three of these cases were so nourished, exclusively, for nineteen days.

Cases are occasionally encountered in which both stomach and rectum become rebellious, rejecting all that is introduced in the ordinary way. In these, feeding by the soft stomach-tube should be resorted to after the plan of Debove, who uses the stomach-tube very extensively in feeding cases of gastric ulcer. Nourishment is often well borne in this way that would be at once rejected if swallowed. In gavage it is unnecessary to pass the tube into the stomach, so that little risk can result from its use if its employment does not cause violent retching. The latter may be obviated by the use of cocaine in the manner already described.

The medicinal treatment of gastric ulcer is entirely symptomatic, as we are still unacquainted with any specific for this affection. Silver nitrate and oxide, bismuth subnitrate, and zinc oxide still have their advocates, though on entirely empirical grounds. Their effect, if any is exerted in promoting cicatrization of the ulcer, must be slight and entirely indirect, perhaps through their influence on the disturbed secretory function and on an accompanying gastritis. Silver salts, as stated by Leube, can scarcely act by virtue of their caustic properties, since it is most improbable that the dose ordinarily administered, which must necessarily be small, can seek out from the whole surface of the stomach the ulcerated spot and deposit itself there. Partially to overcome this objection, and with faith in its direct curative effects on the ulcer, Smith[1] very ingeniously recommends that silver nitrate be given in $\frac{1}{4}$- to $\frac{1}{2}$-grain doses dissolved in an ounce of water, and administered while the patient is lying on the right side, so as to bring the solution into contact with the ulcer if situated in its usual position near the pylorus. Silver nitrate is so readily decomposed, and hyperacidity is so common in ulcer, that it is more than probable that the insoluble chloride is formed on the entrance of the nitrate into the stomach, except in those cases in which acidity is lessened or much albumin or peptone is present; and when the latter is the case the salt would be too much diluted to exert any local effect. As the chloride, because of its insolubility in the stomach, is practically inert, it would appear useless to administer silver, even in the mode suggested by Smith, in cases with hyperacidity; and yet it is in this same class of cases that the employment of silver has its warmest advocates, it being supposed, in some undiscovered manner, to diminish the excretion of a too highly acid gastric juice and thus lessen pain. In the more chronic ulcers with thickened, indurated edges and great depth and extent, in which healing is tardy under the most favorable treatment, and in which hyperacidity is replaced by subacidity due to the development of gastric catarrh, little benefit could result from the use of silver nitrate, even if applied directly to the lesion in the largest dose compatible with safety. What-

[1] *Loc. cit.*

ever benefit resulted would be through its influence on the associated catarrhal condition. Bismuth, too, and zinc oxide—the former of which has been in use for over a century in gastric disorders, especially in ulcer and in gastralgia—can have but little directly curative effect on the ulcer, even when given in the enormous doses (upward of half an ounce) frequently used by the French. The influence of these drugs, like silver, is exerted chiefly in a symptomatic direction. The condition of hyperacidity is advantageously met by the administration of small, frequently-repeated doses of some of the alkalies mentioned. One of the best is that recommended by Smith—precipitated magnesium hydrate ("milk of magnesia"). This preparation is unirritating and has high neutralizing power. It has the appearance and somewhat the taste of milk, and may for that reason be well administered in that liquid. It is preferable to the alkaline carbonates in ulcer, as the evolution of carbonic dioxide in the stomach is avoided. When hypersecretion accompanies hyperacidity, it may be necessary to resort to lavage with the soft black rubber stomach-tube, the use of which is free from risk if not introduced too soon after a haemorrhage or unless violent retching and vomiting are caused by it. Patients who submit to its employment are usually so markedly benefited as regards amelioration or cessation of pyrosis, gastralgia, and vomiting when due to hyperacidity that they desire to continue its use. As a rule, however, its employment is easier in hospital than in private practice.

The old-fashioned Carlsbad crystalline salt, the use of which was first advocated by Ziemssen, is of the greatest utility in ulcer as an antacid and also as a laxative. In the dose recommended by Ziemssen it neutralizes acidity, cleanses the ulcerated surface, and by its effect on the gastric peristole removes stagnant irritating ingesta. This crystalline salt, the chief ingredients of which are sodium sulphate and carbonate, the former in large excess,[1] cannot be efficiently replaced by Carlsbad water or artificial Carlsbad salts containing sodium chloride in any amount, as advocated by Welsh,[2] following Liechtenstein, except in ulcer complicated by gastric catarrh with subacidity, because of the stimulating effect of sodium chloride on gastric secretion and its irritant action on the ulcerated surface.

[1] Its composition is sodium sulphate, 37.69; sodium chloride, 0.39; sodium carbonate, 6; potassium sulphate, traces; water of crystallization, 55.52. This must not be confounded with the Carlsbad salt in powder form, which contains considerable quantities of sodium bicarbonate and chloride. Both of these salts, bottled in Carlsbad, may be procured from any druggist or direct from the importers, the Elsner & Mendelson Co. of New York. They can, of course, be prepared artificially, especially the crystalline salt.

[2] Welsh (Pepper's *System of Medicine*, vol. ii. p. 523) recommends a combination of sodium sulphate, 5 ounces; sodium bicarbonate, 2 ounces; and sodium chloride, 1 ounce. One to two heaping tea-spoonfuls of this, the dose given, would contain from 12 to 24 grains of common salt.

Ziemssen's method of administration gives the most satisfactory result:[1] A table-spoonful is dissolved in a pint of lukewarm water, and one-fourth is taken every ten minutes, half an hour elapsing between the last dose and the morning meal. If the bowels are moved more than twice or not at all, the quantity of salts taken next day must be regulated accordingly, but the amount of water in which the salt is dissolved should be the same.

Pain in gastric ulcer, especially the continuous dull localized pain, with sharp exacerbations appearing shortly after eating, indicating irritation of the nerve-filaments in the floor of the ulcer, is best relieved by either total withdrawal of feeding by the mouth for a few days, rectal alimentation being substituted, or the use of an absolute milk or peptonized milk-gruel diet. Opium or its derivatives should be resorted to rarely if at all, unless the pain is very intense, until the influence of careful feeding has been tried, not only because of the risk of establishing the opium habit, but because the relief obtained by this drug is apt to render the patient less cautious as to diet. If an opiate seem indicated, morphine is preferable to opium itself. It may be used hypodermically if prompt relief is required, or may be given by the mouth, combined with dilute hydrocyanic acid or perhaps with bismuth or other of the drugs mentioned for the relief of gastralgia. Should the pain be localized in the anterior stomach-walls, the application of a small blister or an ice-bag or hot fomentations, if the patient can be confined to bed, will often relieve it. Decubitus is frequently essential to other means for the relief of pain, the latter not decidedly ameliorating until rest in recumbency, supine, prone, or on one side, is tried.[2]

The diffuse paroxysmal gastralgic attacks which are very common and often very severe in ulcer are usually due to radiation of the irritation caused by the implication of sensitive nerves in the ulcerative process, and also by contact of the hyperacid gastric juice with the exposed nerve-filaments in the floor of the ulcer; or gastralgia may be caused by the irritating effect of the acid secretion on the hypersensitive stomach-nerves without implication of the latter in the ulceration. If the circumscribed, continuous, dull pain, with paroxysmal exacerbations soon after eating, is associated with gastralgia, though the same association occurs less commonly in the gastralgia of hyperacidity, a diet of milk or peptonized milk-gruel or similar food should be resorted to. In gastralgia of hyperacidity, alkalies com-

[1] Quoted by Leube, *op. cit.*, p. 222.

[2] Pain is sometimes assuaged by the assumption of a special posture, the relief being most decided after a meal: the influence of posture on the former was thought by Osborne (*Dublin Journal Med. Science*, xxvii. p. 25, 1885, quoted by Welsh) to indicate the locality of the ulcer—relief in the prone position suggesting ulcer of the posterior wall; in the supine position, ulcer of the anterior wall; on the right or left side, ulcer of the pyloric or cardiac region, respectively.

bined with bismuth subnitrate and very small doses of morphine, if the urgency of the pain demands the latter, may be tried. A powder containing 3 to 5 grains of magnesia, 5 to 10 of bismuth subnitrate, and $\frac{1}{16}$ to $\frac{1}{12}$ of morphine sulphate is useful, repeated at hourly intervals, if necessary, until three or four doses are taken. Cannabis indica[1] ($\frac{1}{8}$ to $\frac{1}{3}$ grain of the extract), cocaine muriate ($\frac{1}{12}$ to $\frac{1}{3}$ grain), and belladonna ($\frac{1}{12}$ to $\frac{1}{4}$ grain of the extract), used singly or combined with each other, with bismuth, an alkali, or with dilute hydrocyanic acid, often relieve the gastralgias of ulcer.

Gastralgia not dissipated by the means suggested may occasionally continue after complete healing of the ulcer. It is then probably due to compression of nerve-filaments in the cicatricial tissue of the ulcer, and, unfortunately, is not susceptible of cure by medical means. Flatulent distension of the stomach is sometimes a cause of pain. A few drops of Hoffman's anodyne with mint-water will cause expulsion of the gas. If acidity is present, an antacid, preferably not a carbonate, may be also administered. Charcoal, the power of which to absorb gases in the moist state is supposed to be *nil*, will often relieve flatulence.

Vomiting, especially that due to implication of some of the gastric nerve-filaments in the ulcerative process, is often not controlled till rectal feeding for short intervals replaces that by the mouth. When vomiting occurs and shows a tendency to persist, rest in recumbency is necessary. All food must be withheld save iced milk, peptonized or plain, or peptonized milk-gruel in very small quantities, a tea-spoonful or two at a time. Pellets of ice may be given or very small quantities of one of the carbonated waters, iced, or a not over-dry iced champagne may be tried. Morphine sometimes gives relief, preferably administered hypodermically. The combination of bismuth, carbolic acid, and mint-water previously mentioned is sometimes efficient. An ice-bag, a sinapism, or a small blister to the epigastrium may have to be resorted to—the first two early, the blister after exhausting other means. A brief unsuccessful trial of milk or milk-gruel demands resort to rectal feeding for a period of three or four days, the stomach being allowed a complete rest. Feeding by the mouth is then cautiously renewed, peptonized milk-gruel or peptonized milk, at first in tea-spoonful doses only at very short intervals, being alone used while a tendency to vomit continues.

The occurrence of hæmorrhage from the stomach necessitates absolute rest in recumbency, preferably perhaps on the left side, as recom-

[1] Cannabis indica has been recently highly lauded by G. Sée (*Lancet*, Aug. 2, Sept. 13 and 20, 1890) as a gastric sedative in the pain of neurotic and gastric dyspepsia. When the former is accompanied by hyperacidity he gives cannabis indica with large doses of sodium bicarbonate four hours after meals.

mended by Smith,[1] that gravitation may assist in the arrest of the bleeding, and that the contents of the stomach may be removed from the ulcer should this be situated near the pylorus. Pellets of ice, the most efficient hæmostatic, should be freely swallowed, a light ice-bag laid on the epigastrium, and heat applied to the legs and feet if the extremities are cold.[2] A hypodermic injection of $\frac{1}{6}$ to $\frac{1}{4}$ grain of morphine sulphate is indicated as a vascular sedative and for the purpose of allaying the patient's nervous apprehensions, which indirectly may tend to increase the hæmorrhage through its disturbing influence on the heart's action. Efforts should also be made to diminish by reassuring words the alarm felt by the patient and those about him, and the utmost quiet on the part of the latter must be insisted upon. Leube suggests that the bed-chamber be kept cool and the bed-covering light, in order not to increase the uneasiness of the patient by interfering with respiration.

The utility of ergot in gastrorrhagia is questionable, and, despite the fact that it is generally recommended, the supposed results obtained by its use are probably of the *post-hoc* order. Hæmatemesis in ulcer, if at all profuse, is due to the perforation of an artery, and not to capillary oozing, a frequent cause of the gastrorrhagia of hepatic cirrhosis. When the result of rupture of capillaries or arterioles, the employment of ergot would be beneficial were not its use unnecessary—the bleeding usually ceasing without it. But when the hæmorrhage is due to the opening of an artery, the usual cause of the copious bleeding in ulcer, ergot is positively contraindicated, as pointed out by Smith;[3] for, because of the constricting action of this drug on the vessels being confined to the arterioles, obstruction of the collateral circulation, with increased tension *a fronté*, must occur, which would directly tend to augment the hæmorrhage.

The employment of such hæmostatics as iron, tannin, lead, alum, sulphuric acid, turpentine, and the like need only be mentioned to be condemned. They are not merely valueless in controlling the hæmatemesis of ulcer, given in the only manner in which their administration is practicable, but are provocative of harm by the gastric disturbance their ingestion is likely to incite. The best hæmostatic is ice, the use of which has been already mentioned. The extraordinary suggestion of tamponing the stomach by the introduction of a collapsed

[1] Smith (*loc. cit.*) suggests that as the gastric artery runs from left to right along the lesser curvature, advantage should be taken of the influence of gravitation in the arrest of hæmorrhage, supposing the ulcer is situated near the pylorus.

[2] Drinking very hot water has recently been recommended in gastrorrhagia as an efficient hæmostatic. It is questionable if it can be as efficient as ice swallowed undissolved. The temperature of the water taken would soon be diminished to that just sufficiently warm to dissolve the coagulum at the site of the ruptured vessels.

[3] A. H. Smith, *op. cit.*, p. 529.

rubber balloon through a tube and subsequently inflating it with air, or that of passing a rubber bag into the stomach and filling it with water, with the idea of thus controlling gastric hæmorrhage, is scarce worthy of notice. Apart from the danger of tearing the ulcerated surface or rupturing the stomach when the bag is filled to a sufficient capacity to check bleeding mechanically, the use of such a remedy would scarcely be practicable even within the confines of a Continental hospital.

A still more impracticable suggestion for checking hæmatemesis not readily controlled by medical means is that of Rydygier,[1] who advocates the performance of gastrotomy with the object of excising the ulcer; but the impossibility of accurately locating its situation would alone render this proposition scarce worthy of serious consideration.

Syncope favors cessation of gastric hæmorrhage through diminution in the force of the heart's action, promoting formation of a thrombosis in and about the bleeding vessel. No great effort, therefore, should be made to prevent its occurrence or to overcome it immediately, unless a fatal termination seems imminent through the resulting cerebral anæmia. The patient, if not already in recumbency, should be so placed. By supplying the brain with more blood this position alone, without medication, will often promote a prompt return to consciousness. Alcoholic stimulants must be given cautiously if at all, and never by the stomach. Nitro-glycerin (1 minim of a 1 per cent. alcoholic solution) in a syringeful of ether or in water may be administered subcutaneously, and usually with immediate beneficial result if unconsciousness is profound and prolonged.

Transfusion is indicated immediately after the occurrence of hæmatemesis only when it seems probable that the patient will succumb from the failure of circulation, experience having shown that the increased vascular pressure resulting from transfusion is likely to occasion renewed and perhaps fatal hæmorrhage by leading to the dislodgment of the thrombus blocking the opened vessel. For this reason, the imminence of a fatal termination demanding some such interference, the risk must be taken, but only the smallest amount of fluid should be introduced which is capable of tiding over the dangerous period, and this must be injected very slowly under low pressure. These precautions are less necessary if transfusion is demanded because of the acute anæmia a few days subsequent to the hæmorrhage, when its recurrence seems unlikely. Here a larger amount may be introduced with but little risk.[2]

[1] *Berliner klin. Woch.*, Jan. 16, 1882.

[2] The only risk then being perforation by the suddenly raised pressure, if a diseased vessel in the ulcer is on the point of rupture.

In either event, if transfusion is demanded, the infusion into a vein of a saline solution should be preferred to the introduction of blood. The latter in recent years has been almost entirely replaced by the former, saline solutions practically fulfilling better than blood all the conditions, physical and hæmogenic, to meet which transfusion is undertaken, besides being far safer and easier of application.[1] A ¾ per cent. solution of common salt—about a drachm to the pint—is the most convenient.[2] Not over a half or three-quarters of a pint should be introduced at first. When a recurrence of the hæmorrhage is feared, more can be used later should the urgency of the symptoms again demand it. The solution should be made with boiled, preferably distilled, water. It must be of the body-temperature, and is readily introduced, all that is required being a small glass cannula, a piece of rubber tubing, and a funnel. The fluid might be injected into the cellular tissue, preferably between the scapulæ,[3] in place of a vein. The resulting benefit would be as great, though not so promptly produced, and the danger, that of sudden raising of vascular tension, would be largely obviated.

No food should be given by the mouth during hæmorrhage or for several days subsequently if it can possibly be avoided. The patient should be nourished by the rectum in the manner indicated. Should the latter be absolutely impracticable through the enemata not being retained, a very small quantity of liquid food may be allowed *iced*, such as peptonized milk, milk-gruel, or beef-peptone in bouillon.

Perforation of the stomach, with resulting peritonitis, in gastric ulcer necessitates the administration of full doses of opium by the mouth or morphine hypodermically. Hot fomentations should be applied to the abdomen; absolute rest in recumbency, with decubitus such as to have the ulcer uppermost, should be enjoined. Feeding

[1] See Wm. Hunter's most valuable lectures on transfusion, *Brit. Med. Journ.*, vol. ii., 1889.

[2] As Kroenecker's experiments (editorial in *University Medical Magazine*, abstracted in *Polyclinic*, December, 1888) show that a transfused solution of common salt cannot support the heart unless reinforced by proteids, it is suggested by Ringer that other saline solutions not possessing this disadvantage be substituted for that of simple salt. Ringer considers the best of these to be a solution of tribasic calcium phosphate and potassium chloride—salts representing the necessary ores of blood-serum. These he combines in the proportion of 3 fluidounces of a saturated solution of the former with 85 minims of a 1 per cent. solution of the latter. According to Ringer, this solution will stimulate the heart as well as increase the volume of the blood-stream, and might be substituted with decided advantage for simple salt solution when the introduction of a large amount of fluid is attended with the risk above mentioned.

[3] Galabin (*Transactions Obstetrical Soc.*, London, 1890, p. 5) suggests this method after post-partum hæmorrhage. The common-salt solution—from 1 to 3 pints—is introduced by the aid of a sterilized aspirator needle, a piece of gum tubing, and a large funnel. It is diffused, if necessary, by massage. The flow can be accelerated by running the oiled finger and thumb down the outside of the tube.

by the stomach must of course be discontinued. If the stomach is suspected to contain much food, an effort should be made to evacuate the contents by the tube, a full dose of morphine hypodermically preceding its introduction, and cocaine being used locally to obviate nausea and retching, the last of which will tend to increase the size of the perforation.

Perforation of the stomach, with escape of its contents into the peritoneal cavity, is in the vast majority of cases followed by collapse and death in the course of a few hours or days. Surgical interference is warrantable if it is thought the site of the perforation can be reached by laparotomy. To render the operation successful in these cases a more accurate mode of diagnosing the position of ulcers seems essential.[1]

If chloro-anæmia is decided in ulcer, preparations of iron and arsenic should be resorted to for its removal at as early a period as is compatible with their safe admistration. Prior to this much can be done by the observance of rest in recumbency, thus permitting as slight demand on the vital energies as possible. If the stomach will tolerate it equally well, some form of beef food, such as Mosquera's peptone jelly or that of Leube, should be preferred to a diet of milk. A preparation termed *hæmoglobin compound*, made from the formula of Dr. F. E. Stewart, consisting of fresh defibrinated bullock's blood, extract of malt, glycerin, and alcohol, is of very great value as a nutrient and as a synergist to other foods. It may be administered by the rectum as an addition to the ordinary nutrient enema, or, since it is usually well borne by the stomach and is of very agreeable taste, it may also be given by the mouth. The initial dose is 15 drops well diluted, which, agreeing well, may be increased gradually to upward of a dessert-spoonful three to four times daily. Some little experience with this preparation in anæmic conditions enables the writer to speak with confidence as to its value as a reconstructive.

Enemata of defibrinated blood, of which mention has already been made, are also of especial value in combating the anæmia of gastric ulcer. These, when an anæmic condition is marked, are to be preferred to milk enemata. They are borne equally well by the bowel.

[1] See a case reported by Nissere (*St. Petersburger med. Woch.*, No. 41, 1890, abstracted in *Brit. Med. Journ.*, Jan. 3, 1891) in which perforation and commencing peritonitis consequent on ulcer of the stomach was diagnosed. The abdomen was opened. There was no free gas in the peritoneal sac nor other signs of perforation. The stomach readily presented in the wound, but showed no other abnormality than excessive vascularity of the serous coat. The abdomen was closed without further disturbance of its contents. The patient did well until a month after the operation; abdominal pain and collapse then occurred, followed by death. A necropsy showed a perforation in the anterior stomach-wall, due to a large ulcer at the lesser curvature which had extended to the anterior wall and then ruptured. This had been hidden by adhesions binding the left lobe of the liver and stomach together.

and are absorbed as readily. The preparation of iron which agrees best is the albuminate: this may be prepared extemporaneously by combining egg-albumin with iron chloride,[1] or the solution of iron albuminate made by Drees of Bentheim, Germany, may be prescribed instead. The dose of the last is ½ to 1 tea-spoonful three times daily. It seems to be better borne than other salts of iron, and may be given by the mouth even in the active stage of ulcer and in cases in which hæmatemesis has recently occurred.[2] Small doses of Blaud's pill also agree very well, provided the pill is soft and that decomposition of the iron sulphate and potassium carbonate have not occurred in its construction. The initial dose should be 1 to 2 grains three times daily, gradually increased to a much larger quantity if the stomach remains tolerant. Reduced iron is also usually well borne, and may be prescribed with althæa powder and gelatin made into soft pills, as recommended by Leube.[3] The salts of iron with the vegetable acids, such as the citrate and lactate, are usually easily digested, though of less efficiency than those before mentioned.

It is rarely necessary to resort to the hypodermic method of administering iron: should it be employed in this manner, the least irritating salt is perhaps the citrate, used in aqueous solution in doses of 1 to 4 grains. Arsenic may be given in pill form in combination with iron or preferably alone in solution—the official Fowler's solution or liquor acidi arseniosi; the latter of which seems to be more certain in its effects than the former. Either may be used in doses of 1 drop, increased to several if well borne, three times daily after meals.

Pyloric stenosis not rarely succeeds cicatrization of gastric ulcer and leads to obstructive dilatation, necessitating surgical interference for its alleviation. The question of operation is briefly considered in the therapy of Dilatation of the Stomach.

CANCER OF THE STOMACH.

Cancer of the stomach is not only an incurable malady, but one the progressiveness of which is little subject to retardation by medical

[1] Ewald (*op. cit.*, p. 237) prescribes a tea-spoonful of 2 or 3 per cent. solution of ferric chloride to a wine-glass-ful of a solution of egg-albumin (1 part of white of egg to 2 of water), to be taken through a tube several times daily. This he regards as efficient as the proprietary preparations of iron albuminate, and much less expensive. Tincture of iron chloride alone, well diluted, often agrees very well, and in doses of 3 to 4 drops is recommended by Gerhardt for the relief of the pain of gastric ulcer.

[2] Griffith, *Medical and Surgical Reporter*, May 16, 1891.

[3] Leube's formula is reduced iron and althæa powder, of each 1 grain, and sufficient gelatin to make a soft pill.

means. A consideration of its therapy, therefore, limited as the latter is to mere symptomatology, is less inviting than that of the affections previously discussed. It is, however, of consequence, since, if the downward progress of the disease cannot be decidedly controlled, the accompanying symptoms, which tend to render the patient's last days miserable, may be so far controlled as to permit comparative comfort during this period.

The diet is of the first importance. By its judicious regulation the severity of several of the more distressing manifestations of the disease, such as vomiting and pain, may be diminished, nutrition maintained, and the comfort of the patient promoted until the advent of a fatal termination. Because of the almost invariable absence of free hydrochloric acid from the gastric secretion in advanced cases of cancer of the stomach, and of the tendency of the growth, from its usual situation, to encroach upon and constrict the pylorus, the diet should consist, except in the early period of the disease, when both secretion and motility for a time may be unaffected, only of such aliment as will either readily enter the circulation from the stomach or pass the narrowed pylorus and undergo absorption in the bowel. The diminution in, or more frequently the entire absence of, free hydrochloric acid in the gastric secretion, and the presence of lowered motility, necessitate the administration of prodigested aliment, of which, when the latter is used, animal is preferable to vegetable, as it is less liable when absorption is tardy to undergo fermentation, with the production of the organic acids and other irritating products, the presence of which in the stomach will aggravate the patient's discomfort and increase the liability to development of secretory disturbances; and as there is apt to be a loathing for animal food, largely due to the inability to digest it, an albuminoid dietary can be best taken in a semifluid or fluid condition.

Because of the incurable nature of the malady, however, the inclination of the patient as far as possible should be consulted, the sole object in restricting the dietary being to maintain nutrition and diminish the severity of such of the symptoms as are likely to be aggravated by injudicious feeding. Soft aliment should not be resorted to if solid food can be taken, as the patient soon wearies of it, however palatably it may be prepared. Its constant use, unfortunately, is demanded early in the case, when complete anorexia and pyloric obstruction develop.

In those exceptional cases in which hydrochloric acid is present in excess or in normal amount, or in which its secretion is not decidedly diminished,[1] and the preservation of a fair peristole still permits effi-

[1] There seems little doubt that the absence of hydrochloric acid in cancer of the stomach is due to disturbance of the secretory structure, leading to atrophy of the tubules, most likely produced through the concomitant gastritis. In those rare cases in which secretion of hydrochloric acid has persisted until death, despite the presence

cient gastric digestion and transference of the chyme into the bowel, considerable license may be permitted, ordinary care being exercised that no food is indulged in that causes marked discomfort or that will aggravate the tendency to gastritis, which becomes decided with the progress of the cancer.

When symptoms of pyloric constriction and those of impairment of digestion are absent, whether due to the growth occupying the body of the stomach or when adjacent to the pylorus, though of too small size to obstruct the orifice or interfere with peristole, retention of food in the stomach not being favored, both a farinaceous and an animal dietary may be allowed.

If hydrochloric acid is simply diminished, its presence in a free state still being shown by Günzberg's or the calcium-carbonate test, and symptoms of obstruction are absent or only slightly marked, the administration of hydrochloric acid in the manner and doses suggested in the treatment of Chronic Gastric Catarrh is indicated. Pepsin may also be necessary, though its secretion in carcinoma of the stomach is rarely, if ever, diminished in the same degree that hydrochloric acid is, the former and the milk-curdling ferment being usually present to the end,[1] unlike what occurs in primary gastric atrophy or that secondary to gastric catarrh, in which pepsin, acid, and lab-ferment are all absent. The persistence of hydrochloric acid in small quantity in the combined state only is not an indication for the employment of this acid, but rather for the previous peptonization of all albuminoids ingested, or a resort to an easily-digested farinaceous aliment or to the administration of pancreated preparations with the latter.

A concentrated fluid diet, representing considerable nutriment in small bulk, is especially indicated during the middle and later periods of the disease, when the digestive functions are much disturbed and narrowing of the pylorus has occurred. Some form of peptonized beef should then be used, such as was mentioned in discussing the therapy of chronic gastric catarrh and of ulcer. Yelk of egg may be combined with the most soluble of these, or they may be exhibited with yelk of egg in bouillon. Peptonized milk or peptonized milk-gruel may be used to vary the dietary, as may also such preparations of predigested

of cancer, the mucous membrane, except in the immediate locality of the cancer, has been found in a normal condition post-mortem; and, on the contrary, in those cases in which hydrochloric acid has been persistently absent from the gastric secretion, marked atrophy of the mucous membrane has been found. See Rosenheim's cases (*Berliner klin. Woch.*, Dec. 24, 1888), in which atrophy of the mucous membrane was found in 12 in which hydrochloric acid had been absent from the gastric secretion. In 2 others hydrochloric acid had been secreted in excess. In these the mucous membrane was not atrophied. See also Ewald's case (*Berl. klin. Woch.*, Dec. 3, 1888), in which hydrochloric acid had been diminished and no atrophy was found post-mortem.

[1] V. Jaksch, *Clinical Diagnosis*, London, 1890, p. 110.

beef and cacao, which, taken with milk, are palatable and usually well borne. The amount of nourishment taken at one time should be limited, frequent small meals being preferred to large ones at longer intervals.

Carbonated drinks should be avoided, save in the smallest quantities. Champagne, however, is often well borne, and is an efficient analeptic in doses of a tea-spoonful to a table-spoonful. If stimulants are constantly indicated, a strong not over-sweet red wine agrees best.

When the cancer involves the cardia, producing stenosis of that orifice, usually shown by regurgitation of food immediately after it is swallowed, the presence of persistent dysphagia, of pain situated behind or near the xiphoid appendix, of retraction of the epigastrium, and of an obstruction encountered in the attempted passage of a stomach-tube or œsophageal bougie, fluid food can alone be taken, and the ingestion of this is often impossible without resort to a stiff stomach-tube. The only other resource besides the formation of a gastric fistule is feeding by the rectum. But as life cannot be long sustained by the last, apart from the many disagreeable features attending it, the question of gastrostomy should receive serious consideration. The risk attending the operation is not great, and the comfort of the patient in being nourished in that way instead of by the rectum is very decided. Lavage may be accomplished through the fistula, and medicine as well as food introduced in that way. Ewald recommends in cases in which gastrostomy is performed, and in which, through absence of hydrochloric acid, gastric digestion is impossible, that the fistule be made as near the pylorus as possible, so that the feeding canula may be introduced through the pylorus into the duodenum.

For the relief of pain of gastric cancer opium in some form, such as the deodorized tincture, or, preferably, morphine, is indicated: either may be given in solution with 2 to 4 drops of dilute hydrocyanic acid, and a few grains of bismuth added if vomiting is also present, or in pill, combined with extract of belladonna and cannabis indica. Severe paroxysmal pain, not promptly controlled by the stomach administration of opium, necessitates the use of morphia hypodermically, preferably associated with atropine.

The occurrence of vomiting calls for careful regulation of the diet and a resort to predigested food. When it continues despite a diet restricted to small amounts of iced peptonized milk or milk-gruel, rectal feeding must temporarily replace that by the mouth. The drugs most suitable for its control are those suggested for vomiting accompanying ulcer, such as pellets of ice, tea-spoonful doses of iced carbonated waters or champagne; counter-irritation or an iced bag to the epigastrium sometimes is of service. Occasionally remedies which apparently are least indicated succeed. Thus in a case of Ewald's

weiss beer, which had been craved, was efficient. When vomiting is due to stenotic dilatation of the stomach, occurring at the usual intervals of several days, the ejecta being profuse in amount and much decomposed, it can only be controlled by lavage and a restricted predigested fluid diet, much as in the treatment of gastric dilatation. The hæmatemesis of cancer is to be treated as is that of ulcer.

Gastric catarrh, which occurs with sufficient frequency in cancer to be regarded as a part of that disease, requires an identical therapy to that already detailed in the treatment of gastritis. Of the stomachics for this condition, condurango seems especially worthy of mention. So much benefit, indeed, has resulted from its use in chronic gastritis, in which cancer was also suspected, that it was at one time regarded in the light of a true specific for the latter. Through its influence on the gastric catarrh of cancer vomiting and pain are often lessened, and appetite, in the earlier stages at least, promoted. The best mode of employing it is in macerated decoction, after the formula of Friedreich, the report of whose cases of supposed cancer of the stomach ameliorated by condurango led to its extensive trial in this affection with the mistaken idea that it would prove a specific. Half an ounce of condurango-bark is macerated for twelve hours in 13 fluidounces of water, which is evaporated by boiling to one-half this quantity, strained, and a table-spoonful is taken three times daily. Ewald recommends the addition of a carminative syrup to the decoction to render it more palatable, such as ginger, mint, or fennel, and from 0.3 to 0.5 per cent. of hydrochloric acid to increase its stomachic effect. The last, however, would probably be useless, save as an antifermentative, when free hydrochloric acid is absent from the gastric secretion.

Fermentation occurring in the stomach in cancer, and causing pyrosis and acid eructations, demands a therapy similar to that recommended for the same condition in gastric catarrh and gastrectasis. Daily washing out of the stomach with simple water or dilute solution of the antifermentatives, such as sodium sulphite, boric acid, hydronaphthol, or of bismuth salicylate, is much the best remedy. Lavage also controls the vomiting due to retention and subsequent fermentation of the ingesta, occurring when dilatation arises from constriction of the pylorus. It is, indeed, the most efficient remedy for the relief of all the symptoms accompanying stenotic dilatation, and should be regularly used unless great prostration and a tendency to hæmatemesis are present.

Resort to antacids is more frequently necessary than with chronic gastric catarrh, since we cannot hope more than temporarily to influence the condition originating fermentation in cancer, unlike what is the case in gastric catarrh.

Pyrosis is often very decided, due to the development of large quan-

tities of the fatty acids. Alkalies joined with antifermentatives are then especially indicated. The combinations suggested by Beaumetz[1] are very serviceable, such as a powder containing 5 grains each of sodium bicarbonate, salol, and bismuth salicylate, or of bismuth salicylate, naphthol, and powdered charcoal, or of bismuth salicylate, magnesia, and sodium bicarbonate.

Because of the absence of hydrochloric acid from the gastric secretion in most cases of cancer, the administration of this acid can be of but little avail, either temporarily or permanently, in pyrosis originated by the presence of the organic acids, as a larger amount would be required to prevent the occurrence of fermentation than could at one time be well borne by the stomach.

The obstinate constipation of cancer is sometimes relieved by lavage. Vegetable aperients, aloes, cascara, rhubarb, and the like (mentioned under Chronic Gastric Catarrh), are very serviceable. Saline purgatives should be used with caution; they are apt to debilitate and may lead to diarrhœa. Warm-water enemata are an efficient mode of relieving impaction due to atony of the colon.

Diarrhœa, which occasionally alternates with constipation, and is common toward the termination of the disease, due to irritation of indigestible food or to catarrhal enteritis, can be controlled by opium administered by the mouth or rectum.

Anæmia accompanying gastric cancer, due both to the influence of the cancer on the process of nutrition and to the impaired gastric functions, is sometimes so decided as to approach the condition termed *pernicious*. Indeed, it has occasionally happened that cases of gastric cancer have been mistaken for pernicious anæmia, the symptoms of the former malady not being sufficiently marked to attract notice. The red blood-cells may be reduced to less than a million per cubic millimetre, and assume the distorted shapes and varied sizes characteristic of pernicious anæmia. In other cases, and more commonly, the anæmia may be of moderate grade and show no tendency to develop into the pernicious variety. In all arsenic is of most value to stimulate hæmogenesis, and iron may also be used if coincident diminution in hæmoglobin is present. All treatment can be but palliative, the cause persisting.

The question of operative interference in cancer of the stomach, with the object of extirpating the growth, is one of the highest importance, in view of the utter inability of the physician to accomplish more than alleviation of the chief symptoms, and thus stay the downward progress of the disease for only a short period. This cannot, however, be noticed here in more than the barest outlines.

The mortality attending resections of the pylorus for cancer depends largely upon the amount of adherence to surrounding parts,

[1] *Journal de Médecine et de Chirurgie Pratiques*, 1890, p. 519.

the degrees of cachexia, and the skill of the operator. Too few pylorectomies have been attempted sufficiently early in the disease for a very definite idea to be formed of the immediate risk of operation at that time. The absolute certainty of an ultimate fatal termination of the disease without operation, and the very fair chance of non-return, at least for some time, if pylorectomy could be performed while the disease is yet local and before adhesions have formed and cachexia exists, should cause the operation to be recommended. The risk cannot be so great as that of operation for cicatricial stenosis after dilatation of the stomach, with its accompanying dyscrasia, whether the stenosis be of cancerous or non-cancerous origin. And even in cancerous stenosis the results have been sufficiently encouraging to justify operation in a more advanced stage if the growth is but slightly adherent and debility not too decided.

If the existence of cancer is strongly suspected very early in its course, an exploratory operation, the danger from which in these days of surgical asepsis is trifling,[1] should be resorted to with a view to a confirmation of the diagnosis and extirpation of the growth should it appear that metastasis has not occurred; and, unfortunately, apart from the question of risk attending the operation of resection in cancer of the stomach, cases are usually encountered too late for benefit to be more than palliative, even when the affection is recognized in its earliest stages, as rarely occurs: for, though the tumor may be recent and small, and without definite symptoms, metastasis may already have occurred.[2] When metastases in surrounding parts exist, their complete removal is rarely possible, and a return of the growth in the near future is certain. If the tumor is not very adherent and metastasis is thought to be slight, the strength of the patient permitting, resection of the growth, especially when completely constricting the pylorus, may be indicated, even though its return seems probable, for if the patient survives the operation a period of comparative comfort is assured. If distant metastases have occurred, or the adhesions binding the growth to other parts are too great to justify a pylorectomy, and the patient's physical condition permits, the feasibility of gastro-enterostomy should be considered—indeed, from the risk being decidedly less and the immediate and ultimate[3] result about similar to

[1] Czerny (*Deutsche med. Woch.*, Nov. 7, 1890, quoted by Mears, *Annual of the Universal Medical Sciences*, 1891) reports 14 exploratory incisions, 13 of which were for cancer. Of the 14, 1 terminated fatally on his attempting to isolate a tumor.

[2] In Birch-Hirschfeld's case, quoted by Welsh (Pepper's *System of Medicine*, vol. ii. p. 575), numerous metastases existed in the lymphatic glands of the omentum and of the lesser curvature, though the tumor—a non-ulcerated cancerous one—was not larger than a silver half-dollar and had given rise to no symptoms.

[3] Since the introduction of Senn's bone-plates and Abbé's catgut rings, by which the technique of gastro-enterostomy has been wonderfully improved, the mortality from

that of resection of cancer with existing metastasis, gastro-enterostomy should be preferred in all cases with pronounced pyloric stenosis, in which the probability of a return of the growth after a pylorectomy seems probable.

DILATATION OF THE STOMACH.

THE curability of gastrectasia depends largely upon whether dilatation is the result of atony of the gastric musculature or is secondary to another affection which usually originates dilatation by the production of obstruction of the pylorus.[1] As pyloric stenosis is the most frequent cause of pronounced dilatation, the form for which relief is most often sought, it may be said that an actual cure of dilatation is rarely obtained. This is especially true when the obstruction arises from cancer, which of itself is incurable. It is less true of ulcer or the more rare causes of stenotic dilatation, the obstructions produced by which are more susceptible of permanent removal by surgical means.

The non-malignant stenotic forms, the actual curability of which depends upon the removal of the obstruction, impossible without surgical interference, can by medical means be vastly helped and life prolonged, though they cannot of course be actually cured. Dilatation, however produced, is at least susceptible of decided amelioration, but that form arising in consequence of disturbed digestive functions occasioned by chronic gastric catarrh[2] or by simple atony, originated secondarily by conditions which depress nutrition and cause disturbance of motility, secretion, or absorption, such as tuberculosis, anæmia, or fevers, such as typhoid, or in consequence of habitual excesses in eating or drinking, offers the best chance of permanent cure.

The prophylaxis of gastrectasia is in the main similar to that of gastric catarrh, which, having already received consideration, need not be again discussed here.

this operation has been much lessened. Prior to the use of Senn's plates or some of their modifications the mortality in 24 cases of carcinomatous stenosis was 42 per cent. In 11 cases in which these were resorted to the mortality was but a little over 9 per cent. (See a lecture by Weir, *Medical News*, Dec. 14, 1889.)

[1] As pointed out by Welsh (Pepper's *System of Medicine*, vol. ii. p. 590), cancer and ulcer, though situated near the pylorus, may cause dilatation, not by obstructing the outlet of the stomach, but indirectly by causing partial destruction of the muscular coat, interfering with normal peristalsis.

[2] It might be stated that gastrectasia occurring in the course of chronic gastritis may be due to another cause than primary atony of the musculature or disturbance in secretion and absorption—to an obstructed pylorus produced by diffused thickening of the mucous membrane in this locality, a not uncommon sequence of advanced gastritis.

In the treatment of this affection attention to diet is of the first importance. Without it neither a cure nor decided amelioration in the symptoms can be expected. The food must be of such a concentrated, easily-digestible character that, while meeting the requirements of nutrition, it will tax the various functions of the stomach, especially the motor, as slightly as possible.

Because of the prolonged stay of the ingesta in the dilated organ the aliment should be not only easy of digestion, but, if not already predigested, capable of ready transformation in the stomach into products most easily absorbed from that viscus. For this reason carbohydrates and fats, which are digested chiefly in the bowel, and which have a tendency to undergo decomposition in the stomach, should be permitted only in the smallest amount, and liquid aliment, furnishing small nutriment in great bulk, as thin soups and milk, or beverages, such as water, tea, coffee, and light alcoholic drinks, must also be partaken of as sparingly as possible. Absorption of fluids is always delayed in gastrectasia. These, stagnating in the stomach, distend that viscus by their weight, favor fermentation, and augment the tendency to dilatation.

The most satisfactory diet would be a predigested one, such as is furnished by preparations of peptone, which demand little or no effort on the part of the stomach for their digestion. Food of this sort is, however, soon wearied of, and is indeed habitually indicated only in advanced cases of dilatation, when the secretory function is almost entirely in abeyance. Usually a resort to peptones is necessary only for short periods, and more often in cases of obstructive than in simple atonic gastrectasia. What would appear to be the most satisfactory form of these foods was mentioned in the therapy of Chronic Gastritis and Ulcer. The use of peptonized condensed milk may also be mentioned. This has high nutritive power, a pleasant taste, and, according to Ewald,[1] is not readily wearied of.

From what has been said, it will be seen that the best dietary is an animal one, and in that form most easy of digestion—tender meat, beef, mutton, or fowl, free from fat and fibrous structure, eggs, soft boiled, and the white flesh of fish—essentially, indeed, the diet of chronic gastritis, though in a more concentrated form, with still more sparing use of farinaceous substances. A very limited amount of the latter, however, may be allowed. They are craved by the patient, who cannot be expected to continue long without variation on a restricted predigested dietary. The best farinaceous aliments are those containing the least amount of starch or sugar. Macaroni, stale white bread, and some of the fresh green vegetables, such as young peas, asparagus, and tomatoes, all in small amounts, may be per-

[1] Ewald, *Die Krankheiten des Magens*, 1888, p. 128.

mitted, provided symptoms of indigestion are not induced or aggravated by their use. Fruit may often be allowed when it seems to agree, though in the greatest moderation: grapes (the seeds being carefully rejected), the juice of oranges, the best quality of pears and apples (preferably stewed), are those least apt to occasion gastric disturbance. All thirst-creating foods must be avoided, so that craving for fluids be not engendered when dilatation is decided. Then, also, the quantity of liquid taken at one time should not exceed 6 fluidounces, and ought to be less. As liquids are more readily absorbed in the empty stomach when ingested warm, they should by election be so taken, especially water. A small amount of hot water before a meal will not only assuage thirst, checking the desire for drink with the meal, but will also tend to prepare the stomach for the reception of the latter when symptoms of mucous gastritis are prominent. If the moderate use of milk seems not undesirable because of little other nourishment being taken, a small tea-cupful, alkalinized, may be permitted several times daily, depending upon how it agrees.

In cases of moderate dilatation a little unsweetened coffee or tea may be allowed; wine of good body or a small amount of dilute spirits, if weakness is decided and dilatation is not dependent upon gastric catarrh, may be taken.

It has been suggested, as gastric absorption of fluids is delayed, and as their ingestion is likely to aggravate dilatation and catarrh when much thirst is felt, that this be largely met by water enemata. This is, however, ordinarily necessary only in the grave form of gastrectasia, in which dilatation is decided and gastric absorption much delayed. In the same class of cases, when adequate nourishment is not offered by regulated mouth-feeding, aliment must also be administered by the rectum, or it may be necessary to substitute for short periods rectal feeding for that by the mouth.[1]

To assist the digestion of non-peptonized aliment if secretion of hydrochloric acid is diminished, as it is apt to be from the first, in atonic dilatation, especially when dependent upon a chronic gastritis, and later also in dilatation succeeding pyloric stenosis, even though the latter is originated by ulcer,[2] hydrochloric acid, and perhaps also pep-

[1] The methods of using nutrient enemata and their character are described under Gastric Ulcer.

[2] In dilatation depending upon cicatricial stenosis due to simple ulcer, and in atonic dilatation with absence of catarrhal symptoms, not only the presence of hydrochloric acid in the gastric secretion should be ascertained, but a rough quantitative estimate ought also to be made. It sometimes happens that in consequence of the prolonged stay of the ingesta in the stomach in dilatation without a coexisting gastritis, an excessive production of hydrochloric acid results. See Leo, *Diagnostik der Krankheiten der Verdauungsorgane*, Berlin, 1890, and also Klemperer, *Verhandlungen der Congres für Innere Med.*, Wiesbaden, 1889. The latter found in 17 cases of gastric dilatation without pyloric obstruction hydrochloric acid in excess in 8, normal in 2, and diminished

sin, are indicated, as in the treatment of chronic gastritis itself, which in dilatation not frequently underlies secretory failure. If carbohydrates are also permitted, the digestion will be facilitated by a pancreated preparation administered immediately before or during the meal.

Excepting strychnine, drugs are of little utility in dilatation, save to meet symptomatic conditions. Strychnine justly ranks high as a stimulator of motility through its power to restore tone to relapsed and debilitated muscle-fibre. It is of especial service in gastrectasia not dependent upon obstruction. Through its power as a secretory stimulant also it aids the production of hydrochloric acid.[1] It should be used preferably in the form of the sulphate in doses of from $\frac{1}{60}$ to $\frac{1}{16}$ grain three or four times daily.

The intragastric application of electricity, especially faradism, is of greater utility even than strychnine. It is unquestionably the most efficient agent we possess to reduce the capacity of a dilated stomach and impart tone to its walls. Its beneficial influence in this direction has long been suspected, but its intragastric application has been resorted to only in late years. Canstatt[2] first suggested its use, and Duchenne[3] and Kussmaul[4] soon after tested the method. Since then it has received somewhat general though not very extensive trial, because of the annoyance attending its application due to the lack of a convenient form of gastric electrode. This has been recently largely obviated by the excellent device of Bardet,[5] and the still more useful contrivance of Einhorn. In view of the ease of application of these electrodes or of one of the modifications of Bardet's, and in view also of the beneficial results which, it would appear, may be obtained in cases of lessened secretory activity and in muscular atony with or without marked dilatation, it seems curious that the intragastric application of electricity is not more often resorted to. In dilatation dependent upon constriction of the gastric outlet little can be expected other than temporary strengthening of the musculature, and the maintenance of the latter in a fair state of nutrition; but in atonic dilatation the persistent use of intraventricular electricity should be permanently curative, especially with the combined employment of other

in 7. It is of course important not to give hydrochloric acid in these cases, the character of which can usually only be recognized by the use of the stomach-tube.

[1] Ewald (*op. cit.*, p. 136) states that experiments in his laboratory show that strychnine may be classed as a secretory stimulant.

[2] Quoted by Kussmaul, *Arch. f. Psych. u. Nerv.*, 1887, viii.

[3] The method of using Einhorn's electrode is elsewhere described; Bardet's and other electrodes in the form of a stomach-tube are introduced in a similar manner to the stomach-tube.

[4] Kussmaul, *loc. cit.*

[5] Bardet, *Bull. gén. de Thérap.*, 1884, t. 106, p. 529.

efficient measures, such as lavage. Daily applications, of from ten to fifteen minutes' duration, should be made for a length of time depending upon the promptness with which the dilatation is overcome and its reduction maintained. It should be tried daily for a period of from two to four weeks, and subsequently on alternate days for a much longer time. Its application is so simple that the patient learns to manipulate it himself even more readily than the stomach-tube for irrigation purposes.

The electrical session may be at the time of the morning lavage, a half hour or more before breakfast, or at the same interval preceding the evening meal, or on retiring. The current should be sufficiently strong to produce distinct contractions of the stomach. That viscus must contain a half pint or more of warm water; what remains of this in cases of dilatation had better be afterward withdrawn by the tube. For this reason, if it is thought that the stomach is comparatively free from ingesta, it may be irrigated immediately subsequent to rather than before the electrical application, as then it will be necessary to introduce the tube but once. This will usually be the case after lavage and electricity have been used a few times.

Strong percutaneous faradic applications are also of great utility in gastrectasia, though much less useful than when the electrode is introduced within the stomach. The effects of external faradic applications are not unlike those of massage, inducing indirect gastric peristalsis through the production of contraction of the superjacent muscles, hastening somewhat the onward passage of ingesta from the stomach, thus lessening stagnation in that viscus.[1] It is not improbable that reflex gastric peristalsis can also be produced in this way, the sensory skin-nerves affording the afferent path. The current should be of sufficient strength to produce energetic contraction of the abdominal muscles. Ziemssen[2] recommends for the percutaneous application a large flat electrode. One (600 sq. cm.) is placed on the pyloric region, extending from this toward the fundus, at a distance of not over 1 to 2 cm. from the smaller (500 cm.), which lies between the fundus and the spine. A massage (or roll) electrode may be advantageously substituted for one of the above. By its employment massage, which is often distinctly useful in gastrectasia, promoting the passage of the stomach-contents through the pylorus and aiding secretion, becomes less important than if flat electrodes are alone used for percutaneous applications.

[1] Ewald and Sievers (*Therap. Monatsh.*, Aug., 1887; and *Die Krankheiten des Magens*, ii. 1888, p. 133) found that the salol reaction in the urine could be hastened from fifteen minutes to half an hour by energetic percutaneous faradization of the stomach both in the normal condition and in gastrectasis.

[2] *Allgemeine Diagnostik u. Therap. der Magenkrankheiten*, Leipzig, 1890, p. 239.

The employment of electro-massage or massage alone is most provocative of benefit when used systematically two to five hours after a meal, and for periods of ten to fifteen minutes. The massage movements, both stroking and kneading, should be from the fundus and cardia toward the pylorus, gentle and superficial at first, and after a few minutes' manipulation more energetic. The patient should be supine, with abdomen relaxed. At the termination of each treatment the massage should be extended to the abdominal muscles.[1] Douching of the epigastrium with a small or large stream of cold water or with water at a constantly varying temperature, succeeded by friction with a coarse towel, is also useful, and will often aid strychnine, electricity, and massage in imparting tone to the dilated organ even in intractable cases.

When pronounced bulging of the epigastrium exists, a cushion pad, confined by a bandage, constantly worn, sometimes tends to relieve the sensation of fulness and weight present in gastrectasia.

To relieve ectasic symptoms promptly, to prevent stagnation and fermentation of the ingesta, and to stimulate the stomach and bowels to the better performance of their functions, no one remedy so well meets all the indications, and is so productive of benefit, as washing out the stomach. This should be resorted to at an early as well as a late period of the disease, as soon as the case comes under observation. It should be systematically continued so long as evidence exists of retention of food in the stomach much beyond the normal period of gastric digestion. The unpleasant effects of dilatation, retention and fermentation of the ingesta, periodical copious vomiting, and other symptoms indicative of disordered digestion occurring in consequence of simple dilatation or of an accompanying gastritis, are not only relieved, but in dilatation due to simple atony of the musculature not dependent upon stenosis of the pylorus, and in which decided degeneration of the stomach-wall has not occurred, a cure may be often confidently looked for under systematic daily lavage, even without resort to the other measures suggested, the use of which are, however, also commonly demanded in pronounced cases of gastrectasia in order that results of any permanency be obtained.

Under lavage not only are the symptoms occasioned by stagnation of food ameliorated or removed, and more or less tone restored to the relaxed and overstretched muscles, but the gastric absorbent and secretory functions, often profoundly affected in dilatation, are stimulated

[1] See Cseri's "Mechanical Treatment of Chronic Dyspepsia," *Wiener med. Woch.*, abstracted in *Lancet*, Sept. 20, 1890; also Labludowski ("Zur Massagetherapie," *Berl. klin. Woch.*, p. 443, 1886, quoted by Ewald, *Die Krankheiten des Magens*, Berlin, 1888, p. 132), who narrates interesting results obtained in gastrectasia from massage, and also gives the exact technique of the application.

to renewed activity. In consequence of the beneficial effects, even in cases of incurable stenotic dilatation, which prior to the commencement of lavage have been emaciated and cachectic in appearance to a high degree, an extraordinary change for the better may appear in the course of a few weeks or months, though the amount of food taken has been but slightly in excess of that formerly ingested.

The most suitable time for the performance of lavage is in the morning, half an hour to an hour before breakfast, or at the end of the seventh hour after a meal, when normally the stomach should be empty, and when, if it is not, ingesta remaining, whether partly chymified or wholly undigested, are stagnating and undergoing fermentation in cases of gastrectasis.

Lavage should be systematically done at least once daily, and so continued for weeks until not only maintained improvement in subjective symptoms but decided objective results are noticeable, such as diminution in or absence of dyspeptic symptoms, constipation, emaciation, and in primary atonic dilatation reduction in the size of the enlarged organ. Then, when but slight danger of relapse exists because of prolonged continued improvement, irrigation may be employed on alternate days only, but should be persisted in at least bi-weekly until the long-continued absence of symptoms of dilatation indicates that a cure has resulted, or, if the latter is impossible, for the remainder of life.

Lavage is so simple of accomplishment, and so free from all risk[1] when the siphonage method with the soft tube is used, and relief is so decided that patients soon grow accustomed to the manipulation of the tube. It may be entrusted to them after they have been duly instructed in its use.

The apparatus that fulfils all the requirements for lavage consists of a fair-sized, well-fenestrated soft-rubber tube, either of black or red gum, and a hard-rubber funnel. This should be preferred to more

[1] One untoward result—tetanic spasm or epileptiform convulsions—occurs rarely subsequent to lavage in advanced cases of dilatation when pronounced emaciation and debility exists. These spasms were first noted by Kussmaul, and considered by him to be analogous to those taking place in cholera asphyxia, and due to a similar cause—diminution in the fluids of the body with abnormal dryness of the tissues. Tetanic spasms, the more usual of these rare nerve-disturbances, are more frequent succeeding profuse vomiting or the use of the tube to empty the distended stomach than after mere lavage, though one death has been reported (Martin, *Lancet*, vol. i., 1887, p. 74) from them, following washing out a dilated stomach. As these spasms are more likely to occur when dilatation is pronounced, gastric absorption diminished, and periodical vomiting frequent, it would appear, theoretically at least, that the use of lavage should rather prevent than determine their occurrence; and, as they happen much more frequently after profuse vomiting than subsequent to lavage, this is probably the case. The free use of warm-water enemata when gastric absorption is delayed, fluid being supplied to the tissues in this manner, should prevent them, and the early employment of large doses of nitro-glycerin or amyl nitrite hypodermically, or the latter by inhalation, would in all likelihood promptly jugulate them.

complicated and expensive apparatus,[1] or to the hard-rubber stomach-tube used with the pump, the employment of which possesses no distinct advantage over siphonage with the soft tube, and even in the hands of the physician is not unattended with danger.

The soft, red rubber tube, the consistence of which is somewhat firmer than that of the pure (black) gum tube,[2] is a trifle more convenient to introduce, as its ingestion can be accomplished without efforts of swallowing, and for that reason is preferable to the tube of pure gum. Either of these forms of tube may be employed. It must be of sufficient length for the intragastric extremity to reach the most dependent part of the stomach, and the external portion to extend several feet below the stomach level, to permit of ready siphonage.

The wash-water should be introduced warmed. The quantity used must be accurately noted, that all is withdrawn before removal of the tube. The water should be poured gently into the funnel. The latter must be held slightly above the head of the patient, who may be either seated or standing. After a pint or more of water has continuously passed through the funnel, and while the latter still contains sufficient to prevent the ingress of air with the fluid, the tube is tightly pinched between the fingers and the funnel is lowered to several feet below the stomach level, and the contents siphoned off by slightly inclining the former, so that an outflow will occur without a coincident entrance of air into the tube, which would check the action of the siphon. Water should then be repeatedly introduced and removed until it returns clear and free from suspended particles of mucus and food. If decided gastric catarrh exists, alkalies may be added to the wash-water, as directed under the treatment of Gastritis. When fermentative processes are active, a pint or so of the last wash-water introduced should contain small quantities of a mild antiseptic, such as sodium borate, sulphite, or salicylate; boric acid, the solubility of which is increased by sodium borate, may be used; or, if preferred, naphthalin, resorcin, benzoic acid, potassium permanganate, or one of the many other antiseptic substances in common use, may be resorted to.

Antifermentatives may also be administered in the usual way, as

[1] When mucus or particles of ingesta have a tendency to block the fenestra of the tube when used as a siphon, and cannot be dislodged by the introduction of more fluid or by the expression method, or by voluntarily straining and forced coughing, the obstruction may be removed either by withdrawing the tube or by the application of gentle suction to its outer extremity through a tube of an enema-syringe, or preferably by means of the simple aspirating apparatus used by the writer for obtaining the undiluted stomach-contents after a test-meal. Sufficient rarefaction of air in the bottle can be produced by this to cause a prompt outflow, especially when the bottle is held below the lower level of the stomach, though thick masses of mucus are present or though the ingesta are not fluidified.

[2] These tubes and the mode of introduction have been already described.

directed in the treatment of Chronic Gastric Catarrh and Gastric Cancer.

A tendency to obstinate constipation is present in gastrectasis. This is usually efficiently overcome by lavage. Indeed, the utility of the latter in this direction is so decided and constant that Kussmaul was led to assert that when it does not result a non-compensatable disorganization of the stomach and an irremediable pyloric obstruction may be suspected to exist. As an adjuvant to lavage saline laxatives may be employed. Carlsbad salt in powder or crystalline form, Hunyadi Janos water, or a readily combined substitute for these can be used, ingested warm while fasting, as described in the therapy of Gastritis. The vegetable purgatives there mentioned may also be employed. In pronounced conditions of atony drastic cathartics are sometimes required, such as colocynth and scammony. They should, however, be avoided when possible, because the depression which their action will result in is very dangerous to the subject debilitated by prolonged inanition.

For the more permanent relief of symptoms of dilatation when ectasia is dependent upon pyloric narrowing several surgical procedures have met with more or less favor in recent years. These are pylorectomy, digital divulsion of the pylorus, pyloroplasty, and gastro-enterostomy. It is not within the province of this work to enter into a discussion of the merits of these. The utility of pyloric excision in cancer has already been outlined. This operation, because of its gravity and the high mortality which must attend it, even with the most approved technique and in the hands of those most skilled in the field of gastric surgery, can rarely be indicated in cases of non-malignant stenosis. For the radical removal of simple constriction the operation devised and popularized by Loreta of Bologna, mechanical divulsion of the pylorus, is attended with less risk, and, apparently, affords equally good results. The fear at first entertained that these results would not be permanent —that, as most frequently occurs with dilatation of cicatricial stricture in other situations, such as the urethra and œsophagus, recontraction would occur—seems to have been unfounded, at least as regards those cases in which divulsion is thoroughly effected.[1] The chief dangers attending the operation are shock and hæmorrhage, the latter occurring from the site of the primary incisions and as a result of laceration of the gastric mucosa during divulsion. Fatal peritonitis also occurred in one of Loreta's cases, due to rupture of the peritoneal investment of the pylorus. Since the permanency of the result depends upon the com-

[1] Loreta stated to Bull (*Medical Record*, June 8, 1889) that but 3 of his cases had relapsed; 2 of these were again operated upon, and permanently recovered. Loreta had then, according to Barton (*Medical News*, May 25, 1889), operated about thirty times.

pleteness of the dilatation, the liability to rupture of one or more of the stomach coats is always considerable, even though the divulsion is accomplished very gradually. The mortality in the 25 published cases tabulated by Barton[1] was 40 per cent. In the last 12 of the 25 reported, however, there were but 3 deaths. A fatal issue in most instances is the result of shock, probably due, as suggested by Barton, to the operation being postponed until too late a period in the disease.

Pyloroplasty, an operation devised by Heinicke[2] for the removal of pyloric stenosis the result of cicatricial contraction of ulcer, in which by the use of the knife the narrowed orifice is enlarged, has been performed 4 times with but 1 death. It would appear, therefore, a promising surgical procedure for the relief of simple cicatricial stenosis; but it is not yet time to speak with any degree of positiveness as to its value compared with that of the other better-tested methods in use.

As regards comparative mortality attending operations for the relief of symptoms of stenotic dilatation, whether cancerous or non-malignant, gastro-enterostomy, since the introduction of Senn's apposition bone-plates or some of their modifications, is apparently more deserving of consideration than any of the above-mentioned procedures. Even in carcinomatous stenosis the death-rate under it is comparatively low, and, as suggested by Weir,[3] will very likely be still less, performed for the relief of obstruction not dependent upon malignant disease, in which a cancerous cachexia is not superadded to that induced by inanition alone resulting from gastrectasis. Nutrition in most cases of gastro-enterostomy seems to be adequately preserved, unless the anastomosis is effected at a considerable distance from the duodenum.

In all cases of non-cancerous stenosis subsequent to removal of the obstruction to the onward passage of food into the bowel, if the stomach does not tend to regain its normal size and functions, efforts should be made to promote these by the employment of methods suggested in another part of this article.

[1] *Medical News*, May 25, 1889. [2] *Deutsche med. Woch.*, Feb. 28, 1889.
[3] *Medical News*, Feb. 14, 1889.

CHOLERA MORBUS, CHOLERA, CHOLERA INFANTUM, AND DYSENTERY.

By FREDERICK A. PACKARD, M. D.

Under the name of "cholera" are included several diseases that, having some symptoms in common, differ widely in their etiology, prognosis, and treatment. Differing as they do so essentially, it will be necessary to speak of each affection separately, although in many the means of treatment employed are identical.

CHOLERA MORBUS.

It seems scarcely necessary to enter into an elaborate discussion of the prophylaxis of an ailment the lighter grades of which are so universally experienced. As every school-boy knows how to account for his attack of colic when he has eaten unripe apples, and probably was aware of the risk that he ran when so doing, the physician is but seldom enabled to advise any precautionary measures. There is one point, however, that should be borne in mind—the fact that chilling of the surface, by causing congestion of the digestive organs, may render indigestible an otherwise harmless article of diet. From this fact we may frequently account for the peculiar attacks of suddenly developing, griping, colicky pain, shortly followed by vomiting and copious semifluid evacuations, that are so often seen in this climate during the latter part of August and in September, when we have the combination of hot days and cool evenings.

The lesson here is manifest. In such people as are predisposed to or have suffered from attacks of intestinal disturbance chilling of the surface must be carefully avoided. For those who suffer from this liability there is no protection so perfect as that obtained by the wearing of a woollen bandage about the abdomen and loins. This class of people, as a rule, soon learn the bitter lesson of experience, and discover what articles are apt to upset their digestive equilibrium; this, however, should not prevent our laying down the necessary

rules as to their diet. To those so predisposed there should be given such general rules as are suited to the particular lesion of the stomach or intestines from which they are suffering. Among the numerous articles that are apt to cause such acute choleraic attacks are—green fruit of all kinds, cucumbers, chestnuts, and all such combinations of foods as by their presence in the stomach may produce an indigestible mass. Even milk, usually so readily digested, may become harmful when taken into the stomach in too large mouthfuls, or when, by the addition of acid food in the stomach, it is curdled into a hard mass instead of into flakes. The ingestion of large amounts of water after very intense or long-continued thirst is capable of bringing on an attack. For this reason the advice should be given that limited quantities of water should be taken, and the fact pointed out that the same relief may be obtained by sipping water as by swallowing it in huge mouthfuls. Impure drinking-water may cause an attack of cholera morbus independently of the quantity taken, so that when called to a case suffering from this disease the water-supply should be investigated, in the absence of a more palpable cause, lest others in the household may suffer in like manner.

When called to see a case of cholera morbus, our first inquiries should, of course, be directed to the discovery of the cause. Having learned that unsuitable food has been ingested, we should determine whether any of it still remains in the stomach, or whether that organ has been emptied either by vomiting or by the passage of the offending material into the bowel. Should it be found to be probable that any of the indigestible article or articles still remains in the stomach, emesis should be induced by the ingestion of lukewarm water with or without powdered mustard. If the stomach has already been emptied, our first care must be to remove as rapidly as possible all irritating material remaining in the bowel. For this purpose a readily available, prompt, and often most grateful means of relief will be found in the use of a large enema of water just hot enough to be bearable, to which may be added a table-spoonful of turpentine. Should this be ineffectual, more time must be taken for the production of complete relief, and we have meanwhile to render our patient more comfortable. Externally, the most effectual applications will be found to be repeated hot turpentine stupes or a large strong poultice of mustard flour over the abdomen. Lebert recommends the raising of a large blister over the epigastrium, either by means of ammonia or the hot iron, in those cases that are very dangerous and run a rapid course, and advocates the endermic application of morphine to the surface so denuded. To relieve pain, morphine with atropine by hypodermic injection will act most quickly, or we may prescribe the former by the mouth in some such mixture as the following:

℞. Morphinæ sulphat., gr. $\frac{1}{6}$;
Spiritûs chloroformi, ℥xxx;
Mucilaginis acaciæ, ʒj;
Aquæ menthæ piper., q. s. ad ʒij.—M.
Sig. One half of this mixture to be taken in a table-spoonful of hot water.

Or we may combine tincture of ginger with the morphine.

By this combination of internal and external measures relief will usually be speedily obtained, giving us time to remove the exciting cause. For the latter purpose there is nothing so effectual and harmless as the administration of from $\frac{1}{2}$ to 1 ounce of castor oil, to which 7 drops of deodorized tincture of opium have been added. By this means we remove the offending material from the bowel without adding to the already existing irritation.

To allay the vomiting, if marked, we may employ small pieces of cracked ice or carbonated effervescing waters, or the following mixture:

℞. Creasoti,
Acidi hydrocyanic. dil., āā. ℥ij;
Mucilaginis acaciæ, fʒss;
Aquæ, q. s. ad fʒj.—M.
Sig. To be taken at one dose.

While we wish to empty the bowel of its irritating contents, it may be necessary to check the excessive excretion from the bowel-walls in cases in which exhaustion threatens from this source. By employing nitrate of silver in doses of $\frac{1}{6}$ to $\frac{1}{4}$ grain every two, three, or four hours we may accomplish our purpose without hindering the laxative action of the castor oil.

Should collapse appear imminent, free stimulation may be necessary by means of brandy or ether, combined with the application of external heat. For the painful cramps of the extremities that are at times present dry friction with the hands and the application of hot bags of salt or sand will be found most useful.

For the first eight or twelve hours after the onset of the attack nothing in the way of nourishment should be given; but should there be objective or subjective weakness hot brandy and water, with or without small doses of ginger, may be given according to circumstances. If vomiting persist and stimulation be still required, small quantities of dry champagne may be used.

At the end of the time mentioned above small quantities of milk, diluted with gradually diminishing quantities of hot water, and guarded by lime-water in the proportion of a table-spoonful to 4 ounces of milk,

may be given at intervals of two or three hours. Meanwhile, either the hot applications should be retained on the abdomen or a layer of cotton batting or a thick pad of flannel should be applied.

After the acute symptoms have subsided there is usually left a certain amount of irritation or actual inflammation of the gastro-intestinal tract. Any increase in the amount of food should therefore be cautiously made. Should there be much gastric disturbance, the patient can be easily nourished by partially peptonized milk alternating with small doses of liquid peptonoids. At the same time the following formula will be found useful in restoring the mucous membrane and glands of the digestive tract to their normal condition:

R. Hydrarg. chlorid. mitis,	gr. $\frac{1}{12}$;
Pulveris aromatic.,	gr. ij;
Extracti pancreatis,	gr. v;
Bismuthi subnitrat.,	gr. x.—M.

Ft. pulv. No. 1.

Sig. One every three hours.

Should diarrhœa persist after the disappearance of the more acute symptoms, the intestinal mucous membrane may require more direct medication. For this resulting diarrhœa no drug is of so much value as the salicylate of bismuth in doses of 5 to 15 grains every three or four hours, with which may be combined either denarcotized opium, thymol, α-naphthol, or other intestinal antiseptic.

After the digestive tract has been restored to a more natural condition the dietary should be gradually increased, preference being given to such articles as are almost wholly digested by the gastric juice. Such variations in regard to the rapidity of return to the normal digestive power exist in different individuals that we must, to a great extent, be guided by the sensations of the patient as to the demand for increase in the amount of nourishment. We must not be in too much haste to increase the appetite by the administration of stomachic tonics, as the patient can readily live upon but little food while remaining at rest, and should too much work be thrown upon the stomach, a condition of irritability or actual inflammation may be continued. After the mucous membrane and digestive glands have been relieved of the more immediate effects of the storm through which they have passed, there almost invariably remains a condition of more or less atony of the former. At this stage the use of gastric stimulants may well be considered. The attempt to reawaken activity of the digestive apparatus should be undertaken with caution, in order that by progressively increasing the strength of our remedies we may gradually raise the tone of the affected parts without urging them too vigorously. The following prescription will be found useful:

℞. Sodii bicarbonat., gr. iij;
Extracti zingiberis fluid., ♏v;
Infusi gentian., q. s. ad f℥ij.—M.
Sig. Two tea-spoonsful three times daily.

In this formula the soda aids the secretion of acid by the stomach, the gentian acts as a local stimulant, while the ginger relieves the "coldness" of the vehicle. Later, say in four or five days, a stronger and more generally tonic mixture may be given, such as—

℞. Tinct. nucis vomicæ, ♏x,
Tinct. cardamom. comp., *vel*
Tinct. gentian. comp., q. s. ad f℥j.—M.
Sig. One tea-spoonful before meals.

Should constipation follow the attack, as is apt to be the case, an occasional enema of soapsuds and warm water will usually be found sufficient to relieve the condition. In cases in which the intestinal disturbance has been less marked and persisting, constipation may be well obviated by the use of 1-drachm doses of phosphate of sodium.

During the whole course of treatment, and for the succeeding week or two at least, a binder of thin flannel should be worn, not only to hasten recovery, but to prevent the troublesome subacute enteritis that sometimes persists. Should such a condition as has been just mentioned remain, careful regulation of the diet, with the use of small doses of nitrate of silver in pill form, will usually succeed in restoring the digestive tract to its normal condition.

EPIDEMIC CHOLERA.

Although but little can be said regarding the treatment of cholera during the attack itself, the disease offers large opportunities for saving life by prophylactic measures. The infrequent occurrence within late years of extensive epidemics of this disease has prevented very great advances in our means of treating it when present. It would, however, remove some of our feeling of powerlessness could we feel sure that our prophylactic measures were responsible for the decrease in the former frightful extent of the disease—that we had been able to avoid the necessity for using the pound of cure by the employment of the ounce of prevention. Such epidemics as have occurred have taught us valuable lessons in regard to prophylaxis, while the discovery of the comma bacillus as the probable cause of the disease has

not only explained many formerly obscure points in regard to the spread of epidemics, but has also taught us how more securely to limit it in its ravages.

Many of the predisposing causes of cholera are such that they cannot be remedied by any means at our command short of actual depopulation of a district. For example, it is well established that two of the most potent causes for the foothold obtained by the disease in certain localities are the existence of a shallow, porous surface-soil resting upon an impermeable basis, and the use of a tide-water system of drainage. The former of these cannot, as has been said, be entirely prevented, yet by proper regulations as to the contamination of the surface-soil and the providing of a suitable system of underground pipe-drainage the existing defect may be rendered far less of a menace in times of pestilence. In the matter of tide-water drainage probably ere long the political economists will more effectually appeal to the pockets of communities and arouse them to a sense of their physical welfare. The solution of the drainage question must sooner or later come in the form of a method of disposing of the sewage of large towns more economical and hygienic than are those at present in use.

Leaving these less easily accomplished means of averting the outbreak of the disease, we come to methods more directly within our control. The almost universal system of international and local quarantine has undoubtedly done more to prevent the spread of cholera than has any other single measure. The system at present employed in most countries has been so arranged that, while protecting the inhabitants in the threatened districts, as small an amount of hardship has been inflicted upon those already exposed as is possible The old principle of absolute penning in of the whole afflicted people, sick and well together, has been now so modified that the well may be separated from the ill without coming in contact with those who have not been exposed to contamination. That the former herding together of all who could by any possibility have become infected with those already affected was pernicious, is as true as is the fact that all those so exposed should be detained in an intermediate, probationary station before being allowed to enter healthy areas. During the prevalence of an epidemic, therefore, any one leaving the affected locality should be detained at some intermediate point for at least one week, in order to prevent him from developing the disease after removing to a previously uninfected community. All mail matter or other material that could act as fomites should be thoroughly disinfected by heat before being distributed to other regions.

During the prevalence of an epidemic much may be done to limit the extent of the calamity. At such times all the well-known hygienic

laws should be rigidly enforced. The collection of surface-water or of waste material in the neighborhood of dwellings or near the sources of water-supply should be thoroughly prevented. The organization of a sanitary corps for the carrying out of the necessary measures should be early effected. Besides attending to the enforcement of the matters already referred to, it should be the duty of such a police to close all wells or springs that are even suspected of being in danger of pollution either from surface-water or from cesspools.

All discharges from persons already afflicted should be disinfected, preferably by means of destruction by fire. Should such a means be unavailable, every precaution should be taken that these discharges may not be placed in shallow wells or flow into any stream which supplies drinking-water to other communities farther down its course, or which has an ebb and flow whereby the germs of the disease may be carried backward and forward with each returning tide. As soon as voided the discharges should be mixed with a strong solution of corrosive sublimate and buried at a distance from human habitation.

All excessive excitement, whether religious or otherwise, should be eschewed to as great an extent as is possible. Though panic is an evil to be distinctly avoided, no pains should be spared to instruct the public as to the gravity of the affection, in order that the proper regulations of the sanitary advisers may be carried out. Much could doubtless be effected by proper public information in regard to the laws of diet, the necessity for the avoidance of indigestible articles, unripe fruit, or tainted food, while the importance of heeding any diarrhœal attacks, however slight, should be insisted upon. Particularly should warning be given against excesses in drinking, since it was found in Germany during an epidemic in 1831 that, owing to Monday's excesses, the largest number were attacked on Tuesday, and the least on Saturday.

Should cholera attack one of the inhabitants of a house, all those exposed to similar danger by the use of the same supply of water should be warned to obtain their water elsewhere, or, if this be impossible, should be urged to subject that used for drinking and cooking purposes to prolonged boiling. Where practicable, all of the inhabitants of an infected house should remove to other quarters, whether the patient remain or be removed to a hospital.

To those in charge of a patient ill with this disease special instructions should be given as to the carriers of infection, due warning being given in regard to the avoidance of the ingestion of even the slightest particle of the infecting agent. The most scrupulous care in keeping the hands not only cleansed, but actually disinfected, should be insisted upon. The best method of attaining this end is undoubtedly by the free use of bichloride-of-mercury solutions as a supplement to ordinary washing. All bedding, napkins, etc. should be soaked in bichloride

solution or boiled before being sent to the laundry. The use, whenever practicable, of articles of but little value is to be commended, as they can be destroyed by fire immediately upon being discarded. The evacuations from the bowels should be thoroughly disinfected immediately upon reaching the receptacle into which they are passed, or if the faeces be passed in the bed the clothing should be renewed and the soiled articles burnt, boiled, or soaked in strong corrosive-sublimate solution.

After the attack is over all articles that could have become infected should be carefully subjected to one of the processes mentioned—boiling, burning, or soaking in antiseptic solutions. Could every community have some public oven where, in time of pestilence from whatever disease, all articles of too much value to be destroyed might be subjected to prolonged baking, much might be saved that otherwise may either be rendered valueless or become the source of other cases of the same disease. Such ovens would soon save as much as the first cost of the apparatus.

In regard to the individual, much can be done to avoid the danger of infection. Peace of mind, to as great an extent as is possible in such times of anxiety, is very important. Care in diet, without reduction in the amount of food taken to such an extent as to depress the vitality, is of the utmost importance. The eating of manifestly indigestible articles, unripe or over-ripe fruits, vegetables and meats that are not perfectly fresh, should be carefully avoided. Any slight tendency to diarrhœa should receive prompt attention, and, while laxatives should be but sparingly used, constipation must not be allowed to exist for any length of time. Beyond this, attention to the ordinary laws of hygiene will tend to postpone or prevent the development of an attack.

In treating an individual already attacked by the disease we must be chiefly guided by the symptoms presented. There is no specific remedy for the disease, though many have been brought forward as such. Besides symptomatic treatment our reliance must be put on opium or morphine. During the prodromal diarrhœa the use of these drugs should be early adopted. After the attack is fully developed but little effect can be obtained from drugs, owing to the failure of the mucous membranes to absorb and the lymphatic vessels to carry anything that may be given.

For the severe abdominal pains that are so frequently present counter-irritants over the surface of the abdomen may be used, in addition to the employment of the narcotic. During all stages of the disease, except that of reaction, free stimulation may be called for, and is usually best attained by alcohol, ether, or camphor. The hypodermic use of strychnine might be of value in overcoming the profound depression of all the vital forces, it being a stimulant and tonic to the respiratory, cardiac, and central nervous systems. During the algid stage external warmth, either in the form of hot bottles or cans or the warm

bath, may be necessary. When the intestinal discharges are sufficiently profuse to destroy life, the addition of astringent remedies may be of value. Of these may be mentioned tannin and aromatic sulphuric acid. The internal remedies that are supposed to produce asepsis of the bowel have not as yet received sufficient trial for us to estimate their value, though salol has been used with some measure of success.

Owing to the tremendous drain of fluids from the body, it was at one time very naturally suggested that the intravenous injection of saline solutions might be of value. Unfortunately, however, the results of this method have not justified the hopes entertained in regard to it.

There is one apparently trivial point that should always be remembered in treating a case of cholera—viz. the importance of using the catheter where any doubt exists as to the bladder being empty.

For the painful cramps that are such a prominent feature of the disease nothing will be of much avail, but some comfort may be given by gentle friction with the hand.

During the period of reaction our treatment must be based upon general principles, and must vary with any local lesions and their seat, as would be the case were there any other primary cause. In regard to diet but little need be said. The stomach will probably not retain or the absorbents take up any nourishment during the greater part of the illness. If food can be retained, concentrated and at the same time most nourishing articles should be chosen. Carbonated effervescing waters may be allowed, and cracked ice may be given to relieve the distressing thirst.

During the stage of reaction great caution must be exercised in the matter of diet. Milk, especially if pancreatized, may be given in small quantities. During convalescence the diet should be carefully increased from pancreatized milk to milk with lessening quantities of barley-water, plain milk with lime-water, soft diet (including milk toast, raw egg and sherry, beef-juice, scraped beef, etc), adding article by article until convalescence is complete and the ordinary diet resumed.

CHOLERA INFANTUM.

WHILE to a certain extent a preventable disease, some of the most efficient factors in the production of cholera infantum are practically beyond our control. In large cities the disease in this climate will claim very many victims in spite of our most energetic efforts. The conditions of life in towns are such as strongly to favor its develop-

ment, and it is surprising that any of the infants residing in the poorer sections of our cities manage to escape the disease. When one walks through the "slums" of a city during a hot spell, sees the squalor in which the poorer classes exist, smells the foul odors arising from every gutter and inlet, sees milk exposed for sale in the smaller shops without proper means for keeping it from spoiling, and babies tugging at the nipples of foul nursing-bottles with six or eight inches of fouler rubber tubing, the frequency of the occurrence of the disease cannot be wondered at.

It would be an interesting study should some one engaged in bacteriological work expose for varying lengths of time test-tubes filled with sterilized milk over one of the inlets found at our street corners, and note with what rapidity the milk may become infected. A short exposure would probably suffice to render such food far from sterile. For such a condition of our streets the responsibility must be laid in part upon our street-cleaning bureaus, in part upon the inhabitants themselves. Filthy gutters filled with refuse from the table and kitchen, exposed to a hot noonday sun, soon form breeding-places for almost all species of micro-organisms. It cannot be wondered at that in the neighborhood of such foci milk should soon spoil and infants absorb germs of disease from the atmosphere.

While such a condition of affairs will always be present in towns of sufficient size to have areas inhabited solely by the ignorant poor, we can even in these districts do something toward moderating the chances of an infant contracting the disease. If street-cleaning bureaus and boards of health cannot render a whole neighborhood sanitary, individual householders may be taught the well-known method by which the "streets of Jerusalem were kept clean."

Foremost among the means of preventing the onset of cholera infantum is care in diet. The inability to obtain perfectly fresh milk in cities may be, to a certain extent, compensated by the thorough boiling of the daily supply immediately upon its receipt. This, however, is not alone sufficient, as the milk must be kept sterile until used. Where ice can be obtained and carefully cleansed covered receptacles are in use, this matter can easily be arranged; but in a large class of our town populations ice is an unattainable luxury, while the lessons of cleanliness have never been learned. With such as these preventive measures can hardly be adopted. Frequently have I been told that the infant's milk-supply was placed in the cellar "to keep it cool," and on going into the cellar found it so reeking with the odor of sewer-gas and mould that the living-room of the family seemed sweet and clean by comparison. With such people as these it is usually found that all our directions will be of no avail, and that if the milk-can be not kept in the cellar it will be hung on the back fence near to a foul privy-

well. In these circumstances the best that can be done is to have each bottleful of milk placed in boiling water, after being made up and before using. This, being an additional source of trouble to the probably already overworked mother, will be either neglected entirely or else performed improperly; but we should endeavor to have it accomplished.

Many an attack of cholera infantum owes its existence to the death-carrying long rubber tubes sold in the shops as substitutes for the ordinary old-fashioned glove-finger nipple. No matter how much care may be used in cleaning these tubes, it is impossible to be certain that they are absolutely purified, and frequently they are almost occluded by foul-smelling masses of decaying milk that can be only with difficulty extracted by a strong stream of water or a piece of wire. The more old-fashioned plain nipple, that can be turned inside out and scrubbed, is not only cleaner and more safe, but it is also much cheaper. The great disadvantage that it possesses from the care-taker's point of view is that the child cannot keep on sucking it indefinitely without attention—surely a most beneficial fault. Aside from these sources of disease, the food, even though safely preserved, may be given improperly prepared, in improper quantity, or at too short intervals.

It would take up too much space in an article of this character to go at length into the question of the preparation of food for children of different ages, this being well discussed in the books upon infant hygiene and feeding. It may be proper, however, to insist here upon the fact that thirst may be the cause of the eagerness displayed by an infant for its bottle as often as is actual hunger, and that, during the hot summer months particularly, plain water should be supplied to the infant at regular intervals, in order that the stomach may not be filled with nourishment and compelled to strive to digest food when only water is demanded. The frequent practice of feeding infants "whenever they cry," or of allowing an infant to lie with the long rubber tube from a nursing-bottle constantly in its mouth, cannot be too strongly deprecated. Many an attack of colic that may be merely the forerunner of cholera infantum might be cut short were some carminative, such as a few drops of aromatic spirit of ammonia in a teaspoonful of hot water, given, instead of temporarily easing the child's pain by adding to the flame fuel in the shape of warm milk.

Aside from being indirectly an etiological factor from its increasing the contaminating elements of the food-supply, high external temperature alone seems to be capable of originating the disease. In no other way can be explained the fact that cholera infantum does at times attack the children of well-to-do parents where every precaution has been taken to avoid the introduction of germs into the food-supply. While, there-

fore, improper drainage, filthy surroundings, improper care of the food-supply, and improper manner of feeding may precipitate an attack where otherwise it would not have occurred, the less preventable cause, high atmospheric temperature, cannot be avoided save by change of habitation. On this account children should, whenever it is possible, be either wholly removed from the heated city during the hot spells, or, if this be impracticable, should be given a breath of fresh air in the park or on the river so soon as the sun has lost some of its power as evening approaches. The establishment of public parks and the running of river excursion-steamers permit almost the very poorest to avail themselves of the opportunity to obtain at least a small amount of better and cooler air for their children. The same end is also accomplished by the numerous charitable associations that send mothers with their sick children to the seashore or country.

Teething children are especially apt to be attacked, owing to the accompanying irritability of the gastro-intestinal tract, and to the fact that children during dentition have, as a rule, less power of resistance than at other times. Early lancing of the gums, therefore, is imperatively demanded during hot weather.

When an attack of cholera infantum has already begun, prompt action is necessary. Wherever it is possible the child should be immediately removed to the seashore or country. This removal may be the means of saving its life without recourse being had to any medication. If it is impossible to take the patient away from the city, the coolest and best-ventilated room in the house should be selected for its occupancy. The child should be lightly clothed, and allowed to lie on a bed or in a hammock, instead of being held in the lap of its mother or nurse.

The diet must be carefully regulated to the age of the patient, milk being given with much more diluent than is necessary for a healthy child of the same age. If vomiting be a marked symptom, it is better to withhold all food until this symptom is subdued, the child being merely given frequent sips of barley- or rice-water.

In regard to external measures we must be guided by the condition of the individual case. When the temperature ranges near to 105° F. frequent sponging with cool water, to which has been added vinegar, alcohol, or whiskey, will not only comfort the patient, but will also give material assistance toward cure. Should collapse be marked and the temperature subnormal, the reverse holds good, and external warmth in the shape of hot blankets, hot bottles, or hot bricks should be employed. When the extremities are cold and livid, heat should be applied to the feet, even though the high internal temperature calls for cool applications to the rest of the body. Should the temperature remain high or progressively rise in spite of cool sponging, a wet

pack, made by wrapping the child in towels wrung out of cold or iced water, should be applied as often as may be necessary. Centripetal friction of the extremities will aid in maintaining the circulation, which is, as a rule, very sluggish. Thirst, which is usually urgent, may best be relieved by the frequent sipping of water or the swallowing of small pieces of cracked ice. While plenty of water should be given to make up for the waste occurring in the intestinal discharges, care should be taken not to overload the stomach and thereby provoke or intensify emesis.

For the purpose of supplying the waste of fluids from the body it has been proposed to employ large enemata of water—a plan that is said to act well by those who have used it. Large enemata of water containing creolin in the strength of 1 drachm to the pint have been used with advantage, not only for supplying the additional amount of fluid, but also for the purpose of directly medicating the colon.

Internally we should employ stimulants freely, using brandy, whiskey, or curaçoa. The amount required will vary with the age of the child and the need of cardiac stimulation. From 5 to 30 drops may be given every hour or two. When actual failure of the heart is imminent, carbonate of ammonium in doses of $\frac{1}{2}$ grain to 2 grains may be necessary, but it is apt to increase the vomiting. For the latter symptom we may use cracked ice internally, sinapisms to the epigastrium, lime-water, or the following prescription:

R. Creasoti, ♏ $\frac{1}{8}$;
Bismuthi subnitrat., gr. iij;
Mucilag. acaciæ, ♏ xx;
Aquæ cinnamomi, q. s. ad f℥j.—M.
Sig. Shake well. Take this amount at one dose.

For the diarrhœa we may use several different remedies or combinations of remedies. Opium may be employed, either in the form of one of the preparations made from the crude drug or in that of one of the salts of morphine. The latter form is the better, owing to smallness of bulk and its more certain retention by the stomach. From $\frac{1}{300}$ to $\frac{1}{200}$ grain of sulphate of morphine may be given, combined with aromatic sulphuric acid, and repeated every two, three, or four hours, according to the age of the child and the effect produced.

Salol was but lately strongly recommended for the control of the diarrhœa of cholera infantum; but during the past summer I have obtained very good results by the use of salicylate of bismuth. This has, in the few cases in which I have been able to use it, had a most beneficial effect on both the vomiting and the purging, whereas I found but little good effect from salol when I used it during the preceding summer.

In one hospital, with which the author of this paper is connected, all drugs, dispensed without cost, are prescribed according to a formulary, and from this the two following formulæ were prescribed in combination, oftentimes with astonishing results. The two formulæ are numbered (9) and (54), and are combined in the proportion of 1 part of the former with 3 of the latter. The formulæ are as follows:

(9.)

℞.

Acidi salicylic.,		
Sodii bicarbonatis,	āā.	gr. v;
Aquæ,		♏xl;
M. et adde,		
Tinct. aurantii cort.,		♏v;
Glycerini,		♏xv.

(54.)

℞.

Bismuthi subnitrat.,		gr.vj;
Tinct. opii deodorat.,		♏j;
Syrupi,		♏xx;
Mist. cretæ,	q. s. ad	f℥j.

This has, as has been said, given most excellent results in doses of 1 tea-spoonful every three or four hours. The formulæ can well be condensed into the following:

℞. Tinct. opii deodorat.,		♏j;
Acidi salicylic.,		gr. ij;
Sodii bicarbonat.,		
Bismuthi subnitrat.,	āā.	gr. ij;
Tinct. aurantii cort.,		♏v;
Mist. cretæ,		f℥ss;
Aquæ,	q. s. ad	f℥j.—M.

Sig. To be taken at one dose.

After a few doses the stools lost much of their serous character, became less offensive, more highly colored, and, in favorable cases, returned to the normal character, when the other symptoms could be mitigated sufficiently to permit of life being maintained. The salicylate of bismuth may be given in doses of 2 or 3 grains in powder every two, three, or four hours. The use of opiates requires caution, and their employment should be entirely suspended upon the appearance of stupor or coma.

Where this latter symptom arises, it might be justifiable to resort to the use of intravenous injections of saline solutions, in order to attempt to increase the fluidity of the blood, and so permit of its proper circulation through the blood-vessels.

If the patient weather the storm, removal to the seashore or country should be again urged, as relapses may readily occur. The return to the normal diet should be slowly and very gradually accomplished, while the intestinal tract will require judicious medication to

overcome the resulting inflammatory conditions that are almost invariably present.

DYSENTERY.

Although dysentery will probably never be justly placed upon the list of preventable diseases, much can be done in our endeavor to make it so. The frightful ravages that have so frequently occurred from the appearance of this disease among troops and garrisons have led to careful investigations as to its predisposing and exciting causes. Some of these have been discovered, and may be, to a great extent at least, avoided. That in the *Amœba coli* we have the true, immediate cause cannot as yet be asserted with any great degree of certainty, but further experiments and investigations may throw light upon the question of its etiological importance that will aid us in our attempts at prophylaxis.

There would seem, in the present state of our knowledge, to be several factors in the causation of the disease that may be at work separately or together in individual cases. It is certain that, in this climate at least, more cases occur in the late summer and early autumn months than during any other time of the year. Whether this be due to the fact that during this period we have the combination of warm days and cool nights with much moisture, or to the abundance at this season of various fruits that may readily spoil, or to a combination of these circumstances, cannot be considered as definitely settled. The fact that the disease frequently seems to be induced by impurity in the water-supply would not account for the special prevalence of the disease during the above-mentioned period of the year, unless we presume that the noxious water may be infected by an organic poison whose period of greatest activity occurs at this time.

Although, as has been stated, we have no definite proof of the Amœba coli being the chief cause of the disease, we may safely determine to prevent, so far as is possible, its entrance into the system, if only upon general principles. Further discussion upon the etiology of the disease would be out of place in an article upon treatment, but so much has been said in order to draw attention to a few of the points of importance in the matter of prevention.

In order to avoid the results of contaminated water-supply, careful filtering and prolonged boiling of the water to be ingested should be universally adopted. These precautions are not difficult to adopt, and should be taken as a matter of necessity where any doubt can possibly be thrown upon the purity of the drinking-water, whether in regard to the danger of the onset of dysentery or not. Should

many cases of this disease appear in any locality, these measures should be more carefully practised owing to the likelihood of a common source of poisoning. From the apparent distant relationship between dysentery and malaria it is wise to avoid the use of water that is derived from springs in marshy ground, where the water may remain stagnant, poorly exposed to the influence of oxygen, and contaminated by decaying vegetable matter. When one sees the Amœba coli simulating exactly its larger non-pathogenic congener, whose favorite habitat is in just such collections of vegetable infusions, the possibility of an analogy in their life-habits cannot fail to impress the observer with the thought that stagnant water contaminated by vegetable impurities may play a large part in the causation of the disease.

That the fæcal evacuations of a case of dysentery may carry infection is very far from unlikely. For this reason great care should be exercised in regard to the disposition of the excretions of existing cases. Particularly should the use of shallow pits and privy-wells be carefully avoided, chiefly on account of the danger of contamination of the water-supply from their superficial position and consequent liability to be flushed out over the surrounding ground surface by each heavy rain. Another possibility has been suggested, though it seems somewhat of a refinement—viz. the danger of the disease-poison being drawn into the rectum by the alternate relaxation and contraction of the muscles around the lower end of that structure during defecation into or over such pits as have a meagre distance between the surface of their contents and the level of the ground. This, as has been said, seems to smack of too much refinement in etiology; but, for the other reasons mentioned and on account of the well-recognized evil of shallow pits for the reception of fæcal matter, their use should be entirely avoided.

The part played by the eating of unripe, over-ripe, or spoiled fruit and vegetables cannot be more than an auxiliary cause, as the same materials are eaten during the earlier parts of the year, though possibly not to so great an extent, without so frequently causing the symptoms of a genuine attack of dysentery. It would seem, therefore, that as regards dysentery the use of unsuitable food should be avoided, on account of its liability to produce irritation of the intestinal tract.

Chilling of the surface of the body seems to have some influence in at least predisposing to the disease, and should consequently be avoided, particularly by those who have either had a previous attack of dysentery or are the subjects of intestinal derangement. Fæcal accumulation strongly predisposes to dysentery, owing to the resulting irritation of the mucous membrane.

From these observations it will be seen that our strongest means of avoiding the occurrence of the disease are those that are manifestly connected with ordinary care in personal and public hygiene. In spite of

all our care, however, it is still possible that we may never be able absolutely to control the causes of the disease.

The treatment of a person already attacked by dysentery must vary very much in accordance with both the local condition of the intestine and the general condition of the patient. In many otherwise insignificant cases the tormina and tenesmus may be intense, while frequently the cases that are suddenly struck down by a severe attack may feel and complain of but little discomfort. Our treatment, therefore, must be somewhat symptomatic, but we fortunately have a number of remedies that appear to have almost a specific action upon the disease-process. It will best answer our purpose to consider first the latter class, treating later of the methods to be employed for the relief of the various prominent symptoms.

Foremost among the remedies for which a specific quality has been claimed stands ipecacuanha. This remedy was formerly held in much higher esteem than at present, although it is still used, and with advantage, in some cases. The great disadvantage in its use is that it is impossible to foretell with certainty in what cases it will do good, and in what cases valuable time may be lost while attempting a cure by this means. The remedy has been particularly extolled by the physicians of India, where it may be that the well-known cholagogue action of ipecacuanha causes the good results by stimulation of the liver and intestinal glands in those who have not become acclimated to their new surroundings. The drug may be employed in one of two ways, of which the first mentioned will be found most efficacious in the greater number of cases. In using the drug by the first plan a full dose of 20 grains is given by the stomach, 10 or 15 drops of laudanum having been administered about thirty minutes previously, and repeating the dose in half an hour if the first be vomited, or in four hours if it is retained. The other plan is to give doses of 5 grains every half hour until the patient vomits, after which 10 or 15 drops of laudanum are given, followed by additional doses of ipecacuanha in quantities of 5 to 10 grains at intervals of two or three hours, the drug being introduced in pill form. The first plan will be found to act quickly, if at all; but as many of the patients are already extremely exhausted by their disease, the emesis may act prejudicially by reducing the vital power of the sufferer. It would therefore be safer in cases with marked prostration to endeavor to treat the disease by local and less trying internal remedies, lest the stomach be rendered so irritable by our efforts with ipecacuanha that even stimulants cannot be retained. As in this disease we are, by the nature of the case, prevented from using the rectum as a means of introducing stimulants and nourishment, we should endeavor to preserve the integrity of function of the stomach

most carefully. Therefore, although ipecacuanha is a valuable drug under some circumstances, there are other measures that may first be tried with advantage. Nitrate of silver has been extensively used with good results in the treatment of dysentery when administered both by the mouth and by the rectum. When given by the mouth it is usually combined with opium in the form of a pill, $\frac{1}{8}$, $\frac{1}{6}$, or $\frac{1}{4}$ grain being given every two, three, or four hours, with a quantity of opium varying in each case. This combination of the two drugs, while convenient, has the disadvantage that it prevents us from diminishing the amount of opium used as rapidly as is consistent with the comfort of our patient; whereas the silver should be continued for several hours after the movements have changed both as to frequency and character. For this reason it is, in the end, far more convenient to give the silver and opium separately. Personally, I have seen silver succeed in several cases in which all other means have failed after faithful trial, and should put greatest reliance upon it.

The following case shows very strikingly the effect of nitrate of silver, although a fatal ending was not averted: Hans L——, a Norwegian sailor, aged 52 years, was admitted to the wards of the Episcopal Hospital suffering from dysentery of one week's standing. He was a large, spare man, with pinched features, sunken cheeks, and a dry and fissured tongue that was protruded with difficulty through his parched lips. His teeth were covered with sordes. The extremities, tip of his nose, and ears were cold and livid, the abdomen was scaphoid, and the skin dry and harsh. Small mucous and bloody stools were being passed every few minutes, with much tenesmus. Brandy was at once given in doses of half an ounce each hour, hot cans were applied to the feet, and a large hot flaxseed-meal poultice was applied over the abdomen. As soon as the pulse, which was almost imperceptible upon his admission, had improved in quality, he was given an enema of two pints of cold water. This was repeated in an hour, with but slight effect upon the number of stools or the tenesmus. He was then given salicylate of bismuth, in doses of 20 grains every three hours, without any marked effect after several doses had been taken. One large creolin enema (1 drachm to a pint of cold water) was then given, but as no result was observable, he was put upon $\frac{1}{6}$ grain of nitrate of silver every three hours, while it was expected that another creolin enema would be given later. Although it seems impossible that so small an amount of silver should so rapidly affect such a large surface as the colon, the stools began to occur at shorter intervals, until, after the third dose, they ceased entirely. At this time the general symptoms also improved, while the patient declared that he felt much better. He appeared to be doing so well that no further local medication seemed necessary, while his stimulants were slightly diminished, owing to the improvement in the character of his

pulse. No further bowel movements occurred, and the patient's condition was apparently favorable, until he suddenly died twelve hours after the last stool had been voided.

It might be said that the improvement in this case was due to the bismuth already given or to the creolin enema. This I cannot believe to be the explanation of the rapid amelioration of his symptoms, as I have seen almost as rapid an effect produced by the same drug in cases in which a longer time could be permitted to elapse between other treatment and that by means of the nitrate of silver. That the sudden decrease in the number of his stools was not due to approaching death, as may at times happen, is shown by the marked contemporaneous improvement in his general condition.

Calomel has been much used in the treatment of this disease, with asserted excellent results. Whether its good effects are due to its cholagogue, purgative, or antiseptic properties it is difficult to say; but, judging from the beneficent action of ipecac (also a cholagogue), it would seem that the former is the true explanation of its effect. Opium has been largely—much too largely—used in treating this affection. As in other intestinal affections, we should bear in mind the fact that Nature never cures inflammation by "locking up" the secretions, but that the free discharge of serum from the affected area is the method of relief that is always most successful. We should give opium until the patient's sufferings are relieved, but when we go beyond that point or give the drug for any other purpose, we may hide the manifestations of the disease while increasing its virulence. It is not often that a patient is worn out merely by the pain of a dysenteric attack, and, in fact, it usually takes but a small amount of opium to render him comfortable. For this purpose the drug is best given either by hypodermic injection in the form of morphine, or by the rectum in suppository or starch-water. If the pain be chiefly referred to the anal region, this will ease the pain; but in cases in which there is much tenesmus a suppository consisting of $\frac{1}{2}$ grain of opium with $\frac{1}{4}$ grain of extract of belladonna may be of more value. If the pain be merely that of the tenesmus, we can use local measures, as will be mentioned subsequently, that are just as efficacious, without possessing the disadvantages of opium.

In some epidemics of dysentery quinine by the mouth has been used with advantage. This applies more particularly to those forms seen in camps and on the march, where undoubtedly the chief advantage has accrued from the influence of the antiperiodic upon the malarial poisoning that is almost invariably associated with, if not in part the cause of, the disease. It should in such cases be given in full doses. During the late Civil War in this country this drug was used in large quantities, both as a preventive and curative measure. In the

sporadic cases that occur during times of peace in our latitude it is difficult to see how the drug can be of the slightest advantage; and in fact it is practically never so used save for its generally tonic effect after convalescence has commenced.

Sulphate of magnesium has been quite extensively employed, and has proved of great value. It is chiefly of use in cases with small mucous and bloody stools evacuated with great pain. It is best given in saturated solution, 1 drachm being administered every two or three hours until the stools become of an almost normal color and consistence. A combination of this drug with aromatic sulphuric acid (10 or 15 drops) is often rather more beneficial. After the character of the stools has changed to more nearly that of the normal, a combination of sulphate of morphine with aromatic sulphuric acid will frequently complete the recovery. To disguise the taste of the saline a little extract of liquorice may be added. The treatment by a saline purgative of a disease in which the movements are so frequent as they are in dysentery seems at first thought rather inconsistent; but when it is considered that it is usually not the actual size of the stools which causes danger; when the physiological action of sulphate of magnesium in draining away or locally abstracting serum from the congested vessels of the inflamed intestine is remembered; and, above all, when one sees the stools soon become more natural and the other symptoms steadily subside under the use of this drug,—the supposed inconsistency is no longer apparent.

Should hæmorrhage be marked, the use of ergot is advised by some authors; but it will usually be found that the same result can be better attained by topical treatment in the form of large enemata, as will be mentioned subsequently.

Externally we may employ large poultices of flaxseed or flaxseed and mustard, or we may apply spongio-piline wrung out of hot water. These will be grateful to the patient, and may have some slight effect upon the course of the disease.

Many of the remedies administered by the mouth can act in no other than a purely local manner upon the affected area. This is true of bismuth, tannin, and numerous other drugs. It is therefore much more rational to attempt to obtain this local action by the direct application of the remedy to the seat of disease. This can readily be accomplished by the use of enemata, whereby we not only save the stomach, but are also able to determine more accurately the amount of the drug that reaches the objective point.

Simplest among these remedies are enemata of pure water. These can be used either at the temperature of ice-water or at 102° F. The choice of temperature may be in part made by a consideration of the

general condition of the patient. If there be subnormal temperature with other symptoms of collapse, as is often seen in hospital practice, where patients apply for admission late in the course of the disease, hot water is preferable; but if the general condition of the patient is sthenic, better results may be expected from the use of cold. These enemata should be *large*, each consisting of from 2 to 3 pints, and are best introduced from a gravity syringe, the reservoir being held about a foot or eighteen inches above the level of the patient's body. As a rule, the anus is extremely sensitive, and it is therefore important to use a blunt-pointed nozzle, to have it well anointed with some lubricant, and to effect its introduction very slowly and gently. Should there be much suffering caused by the introduction, a suppository of opium and belladonna may precede the use of the syringe, or the parts may be painted with a solution of cocaine. The patient should lie upon the back, slightly inclining toward the left side, and with the hips elevated. Should pain be experienced during the injection, the current should be stopped, being again allowed to flow so soon as the pain has diminished. That these injections cannot be safely made without care is shown by a case reported by Ball, in which acute diffuse peritonitis followed immediately after the injection of a pint of salicylic-acid solution into the bowel of a child suffering from dysentery. In this case none of the fluid returned, and, although recovery ensued, it is more than likely that some weakened portion of the intestinal tube gave way into the peritoneal cavity. This accident may be best avoided by holding the reservoir of the injection apparatus but a short distance above the patient, and by temporarily withdrawing pressure upon complaint of pain. The danger of perforation is of course greater the further the disease-process has advanced.

Numerous medicaments have been used to increase the benefit derived from large enemata. Among these are alum (1 drachm to the pint), creolin (1 drachm to the pint), corrosive sublimate, quinine, and nitrate of silver. Of these I have personal experience with none but creolin. I have used it in a moderate number of cases with much benefit, the stools decreasing in frequency, their character becoming more natural, their odor less offensive, tenesmus practically abolished, and the patient much more comfortable after one or two of the injections at intervals of four hours. In one or two cases this method failed to do more than slightly ameliorate the pain and lessen the odor of the stools. Alum enemata may be given in the strength above indicated. They have been highly recommended by many observers, and the benefit derived from their use would seem to be most marked in the strongly hæmorrhagic cases. Corrosive sublimate may be used in 1 : 5000 solution, of which 7 ounces are to be injected two or three times daily. This method has the disadvantage that but a small quantity

of the solution is used, thereby losing the advantage derived from flushing of the whole colon. Quinine may be used, according to the plan adopted in the Johns Hopkins Hospital, in solutions of 1 : 5000 strength. Large injections of nitrate of silver in the strength of 10 grains to 1 drachm in a pint of water may be employed, but they are more often of use in the chronic than in the acute form of the disease.

Other local means may be adopted to cure or to relieve distressing symptoms. Iodoform suppositories of 5 grains each will greatly relieve the tenesmus, frequently acting as quickly as opium, without any of the disagreeable effects of the latter drug. Suppositories of ice, made by moulding a piece of ice by means of friction into the conical shape of an ordinary suppository, are often a source of great relief when introduced at short intervals; more than a palliative effect cannot be claimed for them. Should hæmorrhage be very marked and the blood of a bright color, suppositories of tannin (5 or 10 grains) may be sufficient to control it, as the source of the blood in these cases is frequently within easy reach of the tannin as it becomes diffused over the rectal lining.

In almost all severe cases stimulation will be necessary. This can be best accomplished by alcohol in the form of brandy or whiskey. The amount to be given must depend upon the wants of each case, though larger quantities of stimulant may be employed than are usually administered in other affections, owing to the fact that a few hours may decide the favorable or unfavorable course of the disease, and because by free stimulation life may be maintained for a sufficient time to allow of cure by more direct treatment. An ounce of whiskey or brandy every hour, or even half hour, may be needed to keep the patient alive until the symptoms are subdued sufficiently to allow of reaction occurring.

The diet during the acute stage should be limited to milk diluted with water and lime-water, given in small quantities at frequent intervals. Raw egg, beaten up with sherry and a trace of nutmeg, may be given as a convenient form of nourishment and stimulant. Cracked ice may be allowed *ad libitum*.

After the acute symptoms have subsided and convalescence begun the diet should be cautiously increased until the usual articles have been added. A small and gradually decreasing amount of alcohol will usually be advantageous in hastening convalescence. Should the disease tend to become chronic, counter-irritation over the abdomen, care in diet, proper clothing, and the internal use of nitrate of silver in pill or by enema may be tried. In some cases change of climate may be needed ere the disease can be thoroughly eradicated.

There are practically but two complications that are likely to occur, besides those dependent upon the asthenic or typhoid state.

These are perforation of the bowel and abscess of the liver. The former is relatively of infrequent occurrence. Should perforation occur into the peritoneal cavity, a slender chance for recovery might be afforded by surgical measures. Unfortunately, these secondary abscesses are apt to be multiple, and consequently not curable by surgical means. The latter condition, abscess of the liver, can only be treated by surgical means in the same manner as would local collections of pus in other situations. None but general remedies can be of any avail when the abscess ruptures into the lung or digestive tract.

Should the disease subside into the chronic form, every effort must be made to improve the general condition of the patient by means of tonics, carefully-regulated and nourishing diet, and an abundance of fresh air. Hard pills of nitrate of silver and opium ($\frac{1}{6}$ grain of nitrate of silver combined with $\frac{1}{3}$ or $\frac{1}{6}$ grain of opium) should be given one hour after meals, while the silver salt may also be utilized in occasional large enemata consisting of 1 drachm to a pint of water. After using these injections the nitrate of silver should be neutralized by a large injection of chloride-of-sodium solution in order to obviate any danger of argyria. In addition to the points already mentioned, it is well to insist upon the wearing of a flannel binder. Counter-irritation over the abdomen will be of assistance, and may be best made by the use of tincture of iodine. The diet should consist of such articles as are digested by the upper portion of the gastro-intestinal tract and leave but little residue. Change of climate may be necessary in order to complete the cure of this oftentimes most obstinate condition.

OBSTRUCTION OF THE INTESTINES.

BY EDWARD MARTIN, M. D.

OBSTRUCTION of the intestines may be caused not only by the mechanical closure of the lumen of the bowel, such as occurs in case of strangulated hernia, but also by certain pathological states, such as peritonitis or enteritis, which by occasioning a paretic condition of the muscular coats of the intestinal wall favors stasis, with resultant fermentation of the complex organic compounds contained in the alimentary canal and the development of typical symptoms of obstruction, accompanied by those of either inflammation or of septic absorption.

Clinically, cases of intestinal obstruction are classed as acute or chronic, depending upon the violence of the onset and the severity of the course of the disease. No sharp distinction can be drawn between the two, and each is liable to merge into the other.

Acute intestinal obstruction may be due to congenital malformation; to invagination or telescoping of one portion of the bowel within another; to internal strangulation by bands, diverticula, membranous adhesions, constrictions through apertures, or attachments of organs not in themselves diseased; to volvulus or twisting of the bowel; to impaction of foreign bodies; and to intestinal paralysis and distension.

Chronic obstruction is commonly due to stricture, to neoplasms, to pressure external to the bowel, or to impaction of fæcal masses.

CONGENITAL MALFORMATION.[1]

Narrowing or obliteration of the intestinal tract at birth may be found in any portion of the small or large gut. In the great majority of cases observed it is only in the region of the rectum or anus. Other seats of preference are the duodenum, the neighborhood of the ileo-cæcal valve, and the sigmoid flexure.

As observed in the lower bowel, this deformity may appear as a narrowing (partial occlusion), atresia (complete occlusion), or absence (imperforation) of the anus, of the rectum, or of both these structures. At times there is observed a stenosed opening in an abnormal position.

A careful statistical study of cases of congenital malformation shows

[1] For further consideration of this subject see article on Rectal Diseases.

that it is multiple in 28 per cent. of all cases, and that in 10 per cent. it is of such a nature as to be mechanically irremediable.

The symptoms of congenital malformation causing obstruction of the bowel are the same as those from obstruction dependent on any other cause. Shortly after birth fæcal vomiting, pain, and tympany, together with absence of evacuation from the bowel, will sufficiently indicate the nature of the attack, even though the malformation cannot be detected upon inspection.

The treatment of this condition is surgical. When atresia depends upon a thin membrane occluding the anus, a simple incision will give relief.

For imperforate anus the coccyx should be excised, and the bowel should be sought for by cutting upward and backward. The incision should not be carried deeper than an inch and a half at the most. If the bowel is found, it should be brought down to the skin wound and stitched in the position that the anus would normally occupy.

If the rectum cannot be found by this incision, the cut for left inguinal colotomy should be made. If the finger passed into the peritoneal cavity finds that the perineal incision can be safely deepened, with a condition of the rectum which will allow of its being drawn through this opening, the operation first undertaken should be completed and the inguinal incision should be closed. If, however, the conditions are such that an attempt to form a new anus is inadmissible—as, for instance, when there is complete absence of the rectum and atresia of the sigmoid flexure—left inguinal colotomy should be performed. The gut should be held in place, after suture of the skin to the parietal peritoneum, by a piece of rubber catheter passed across the wound and through the mesentery close to the bowel. Stitches should of course be inserted. Before securing the bowel in this way a digital examination should be made in the regions of the ileo-cæcal valve and duodenum, since malformation is frequently multiple, and these are the commonest seats of imperfect or arrested development.

If the obstruction does not depend upon atresia of the anus or rectum, exploratory abdominal section should be performed in the hope of finding the seat of trouble, and of remedying it by colostomy, enterostomy, or lateral anastomosis.

Intussusception.

The term intussusception implies that one portion of the gut is invaginated or turned within the lumen of another part immediately adjoining. This forms a tumor made up of three layers of bowel. The *intussusceptum* is composed of the entering and returning layers, while the receiving layer is called the *intussuscipiens* or *sheath*. Usually the

upper segment of the gut is received into the lower. "Retrograde intussusception" is a term applied to a condition the reverse of this.

The invagination may be *enteric*, involving the small intestines only. It may be *ileo-cæcal:* in this form the ileum and cæcum, together with the ileo-cæcal valve, are turned into the colon. It may be *ileo-colic:* in this form the ileum is prolapsed through the ileo-cæcal valve, the latter retaining its proper relative position until, as a result of secondary changes, it, together with the cæcum, is more or less displaced. It may be *colic*, in which case it involves the colon only. Or it may be *rectal*, the seat of trouble being situated entirely within the rectum.

Invagination in itself does not entirely occlude the lumen of the bowel. Complete obstruction, however, frequently results from swelling of the involved area, dependent upon constriction at the neck of the sac, and from lodgment of fæces. As a result of the inflammation excited by the constriction the serous surfaces of the entering and returning layers of the invagination frequently become adherent.

Invagination is one of the commonest causes of intestinal obstruction. In the first year of life obstruction from invagination is more frequent than from the sum of all the other causes occasioning this condition. After the fifth year intussusception becomes comparatively rare till the fortieth or fiftieth year, when it again increases in frequency of occurrence. The ileo-cæcal region is the favorite seat of invagination.

The onset of intussusception is characterized by sudden violent pain. After some time, usually a few hours in children, the pain ceases as suddenly as it commenced, and there is an interval of quiet. This is followed by a return of pain, the paroxysms becoming more violent and prolonged and the intervals becoming less marked as the disease progresses. Vomiting is an almost constant symptom. Its severity bears relation to the degree of obstruction rather than to its seat. Blood-stained mucous evacuations are rarely absent. In children diarrhœa is common throughout the whole course of the case. In connection with the muco-sanguinolent evacuations, tenesmus or straining is very marked. In more than half the cases a tumor can be felt in the left iliac region or by the finger passed into the anus. If this tumor is carefully observed, it may be found to have an erectile and a vermicular motion.

In the chronic form of invagination there may be no symptoms other than recurring paroxysms of pain, meteorism, and obstructive symptoms.

The mortality of intussusception as treated by the expectant method is about 74 per cent. The chances for life are best when the disease occurs at about the age of puberty. Sloughing and discharge of the

intussusception are favorable signs, since 41 per cent. of cases in which this occurs recover.

The treatment for intussusception may be either medical or surgical. The statistics of abdominal section for invagination give the mortality percentage as 75.4. There can be little doubt that in reality it is even higher than this, since there is a natural tendency to report only favorable cases. Abdominal section has usually been considered only after days spent in repeated and ineffectual efforts at reduction, when the patient's strength is far spent and immediate death is staring him in the face. Under these circumstances it is unfair to compare the statistics of operative cases with those treated expectantly, yet the mortality against the surgeon is less than 2 per cent.

Considering the class of cases in which section has been employed, any percentage of success would be encouraging; if resorted to when all conditions are favorable—that is, immediately after one thorough effort to accomplish reduction without operation—the percentage of recovery would probably be so high that even the most conservative would be disposed to recommend this form of treatment.

The medical treatment of intussusception is exceedingly simple. Morphine and atropine may be administered hypodermically in quantities sufficient to relieve the acute suffering. Lavage of the stomach may be practised if the vomiting is frequent and exhausting, and particularly if the eructated matter is very offensive. As a mild antiseptic boric-acid solution may be employed in place of water alone.

The pathology of intussusception shows that disinvagination becomes difficult in direct proportion to the length of time which has elapsed since the onset of symptoms; hence every hour that treatment is delayed diminishes the chances of success. Provided the case is not of such long standing that tight adhesions have probably made reduction impossible, or strangulation has produced a partial necrosis, ether should be administered to its full surgical extent, producing complete relaxation of the muscular system. By means of a fountain syringe a 0.7 per cent. saline solution at a temperature of 105° F. should be slowly forced into the rectum under a pressure of not over two pounds to the inch. (Elevation of the reservoir four feet.) The liquid is prevented from running out of the bowel by means of a shoulder upon the injection-pipe, readily made by wrapping the latter with a narrow bandage. The abdomen should be gently kneaded. This treatment should be continued for thirty or forty minutes, the pressure being gradually increased till it reaches eight pounds. This is obtained by elevating the reservoir sixteen feet. This trial at forced reduction must be thorough and final. There should be no idea that it is to be repeated with more care and attention to detail.

If there is a distinct tumor, the probable success of the method

above detailed will be denoted by its disappearance; the positive failure by the tumor occupying the same position as before treatment and retaining its full size. In the latter case the surgeon should proceed to operate at once, while the patient is still under the influence of the anæsthetic. In the majority of cases the success of this forced injection can be determined only by allowing the patient to come out of his ether; the progress of symptoms will then quickly decide as to whether a cure has been effected or not. Section should be performed the moment it becomes clear that invagination still persists.

When the severity of the symptoms and the amount of obstruction denote marked strangulation, and the patient has not been seen for several days from the onset of the attack, abdominal section should be the first resort.

If there is a tumor, incision should be made over it. In the absence of this sign the opening should be made in the linea alba below the umbilicus. When the invagination is found, it should be reduced by grasping the tumor at its lowest part and endeavoring by gentle continued pressure to reduce the venous congestion; then by traction from above and pressure from below the reduction will be much facilitated. If adhesions are formed about the neck, these may be broken up by a probe passed between the entering and returning layer and carried around the circumference of the bowel. If the adhesions are so tight that restoration of the gut to its normal position is impossible, unless the patient's strength is exceptionally well preserved, an enterostomy and the formation of an artificial anus will afford the best hope of recovery, since spontaneous resolution may subsequently take place with complete restoration of the continuity of the alimentary canal. Or by means of a lateral apposition the invagination may be entirely switched out of the alimentary tract. If gangrene has set in, resection with either the formation of an artificial anus, or in exceptional cases the performance of a lateral approximation, will be indicated.

Internal Strangulation.

Next to intussusception, internal strangulation ranks in order of frequency as a cause of intestinal obstruction. It commonly occurs in males between the thirtieth and fortieth years, and is in the great majority of cases due to the remains of a former peritonitis. It may be due to isolated peritoneal adhesions, to cords formed from the omentum, to Meckel's diverticulum, to normal structures abnormally attached, or to slipping of the gut through slits and apertures.

Internal strangulation may be sudden or gradual in development. Usually without cause there is sudden agonizing pain located about the umbilicus; this pain is constant, but has paroxysmal aggravations.

There is vomiting; this is constant, gives no relief to the patient, and becomes fæcal about the third day. There is constipation, which becomes absolute as soon as the bowel below the seat of obstruction is emptied. There is often localized tenderness and percussion dulness, which when present denote with some certainty the position of the strangulated bowel. There is some meteorism, and the pulse becomes rapid and weak. Unless inflammation develops the temperature remains about normal or a little below. The urine is greatly diminished in quantity and contains albumin.

The treatment of internal strangulation is obviously operative. Although a cure is possible, either by the rupture or absorption of the constricting band or by an intestinal anastomosis by ulceration, this result must be exceedingly rare when the condition of strangulation is fully established. Injection, massage, electricity, or any or all of the therapeutic means usually resorted to in cases of obstruction, can only by the merest accident be of the slightest avail. In any case of obstruction characterized by such fulminant symptoms as are common in strangulation, abdominal section with the idea of mechanically removing the cause of obstruction should be the first resort.

At times the onset of the malady is signalled by most profound shock; this may demand treatment before operation can be performed. External heat, full doses of morphine and atropine administered hypodermically, and whiskey by the bowel, 4 ounces diluted with eight times that quantity of hot water, offer the best hope of promoting reaction. Should the shock not yield to this treatment, and should the symptoms be steadily progressive, anæsthesia should be produced by the least possible quantity of ether, the abdomen opened, and a hurried search made for the seat of constriction. This should be relieved as rapidly as possible, and the peritoneal cavity should be flushed with hot saline solutions. If under these circumstances—that is, operation during profound shock—the seat of obstruction cannot be found, or if found the obstruction cannot be readily overcome, an enterostomy is clearly indicated.

When the patient is in good condition a free parietal incision should be made: the congestion and discoloration of the strangulated bowel, the distension above the point of occlusion, and the empty, flaccid condition of the intestine below will each serve as valuable guides to the seat of trouble. Not only should the constriction be relieved, but the constricting bands should be entirely removed. Thus, if the appendix is the seat of trouble, its ligation and complete removal are indicated.

It is a matter of prime importance after relief of the strangulation to evacuate the distended and paralyzed bowel. This may be accomplished by means of one or more incisions, which can be closed readily by means of the Lembert suture. When the obstruction is due to the

matting together of a number of intestinal coils, unless the adhesions can be readily broken up the safety of the patient will be consulted best by performing either an intestinal anastomosis between the healthy bowel leading to the adherent coils and that leading from them, or by forming an artificial anus. Constant peristaltic and respiratory intra-abdominal motion may ultimately cause the complete disappearance of extensive intestinal or omental adhesions.

In cases of strangulation alimentation should be administered by the rectum, and stimulants used freely either by the rectum or subcutaneously. The stomach should be washed out thoroughly, this treatment being repeated in proportion to the severity of the vomiting. Absolutely nothing should be given by the mouth. After the cause of the constriction has been removed a saline purge acts as a valuable aid in restoring tone to the paretic bowel.

VOLVULUS.

Twisting of the bowel is the cause of intestinal obstruction in about 3 per cent. of all cases. The twist is usually about the mesentery as an axis. This form of intestinal obstruction occurs most commonly in men past middle life who have long suffered from constipation. The sigmoid flexure is most frequently affected. Even in the form characterized by the intertwining of several loops it is with the sigmoid flexure that the small bowel usually becomes entangled.

A long mesentery with a comparatively narrow attachment is necessary for the development of the twist. This may be congenital; more commonly it is acquired, years of constipation so dragging upon the sigmoid flexure that it is greatly elongated, the two extremities being constantly more approximated until the condition suitable to the development of the trouble obtains.

Venous congestion plays an important part in the changes dependent upon volvulus. The involved loop becomes engorged with blood and immensely distended from decomposition of its contents. Peritonitis is very frequently developed. The constricted portion of the bowel becomes gangrenous. As in other forms of intestinal obstruction, obstinate constipation, vomiting, and abdominal distension are present. The disease has no distinctly diagnostic features, but should be suspected when in a man at or past middle age, of constipated habit, severe but not agonizing pain, attended with symptoms of moderate shock, inaugurate an illness characterized by moderate bilious vomiting, absolute constipation, and great abdominal distension, with tenderness appearing shortly. Tenesmus and a history of distension, first appearing in the region of the colon, would still further strengthen the diagnosis.

The treatment for obstruction from volvulus is purely surgical.

Purgatives are as evil in their effects as in other forms of obstruction, and their administration has often been the starting-point for the onset of acute general peritonitis. A gradual forced injection of water with the patient in the knee-elbow position may possibly accomplish reduction before the bowel is fixed in its abnormal position by distension, congestion, and peritonitis.

If the diagnosis is fully established, no time should be lost in opening the belly, untwisting the bowel segment, and evacuating its contents.

Enterotomy may be necessitated by gangrene and by the impossibility of retaining the bowel in a normal position.

Lavage of the stomach, the avoidance of food by the mouth, and in general the treatment applicable to other forms of obstruction are valuable in cases of volvulus.

Obstruction from Foreign Bodies.

Under this heading are considered not only those cases of obstruction due to foreign bodies which when swallowed lodge in some portion of the alimentary canal and mechanically block the onward passage of its contents, but also those cases in which acute symptoms are produced by intestinal concretions, enteroliths, gall-stones, hydatids, or any mass sufficiently large to block the bowel.

A foreign body which has passed into the stomach, if of large size, will probably be arrested in that viscus. Should it pass the pylorus, it will probably lodge in the cæcum. If the cæcum is safely passed, its final evacuation is not yet assured, since the rectum is also a favorite lodging-place for these bodies.

Large numbers of small bodies may be swallowed which individually can readily pass through the bowel, but which taken in great quantity may form a conglomeration sufficiently large to produce occlusion. Cherry-stones frequently act in this way, and cases are on record where concentric masses of hair filling the stomach and small intestines have caused death from obstruction.

In the majority of cases the œsophagus is an accurate gauge as to the possibility of a body passing the entire length of the alimentary canal, the chances being largely in favor of spontaneous discharge of whatever has passed into the stomach through the cardiac valve. Bonet states that Charles II. of England placed a razor and two knives in the mouth of a professional sword-swallower; they were swallowed, and discharged *per anum* upon the third day.

The diagnosis of obstruction from foreign bodies will usually depend upon the history of the case. If the symptoms are caused by the lodgment of a gall-stone in the bowel, there can commonly be elicited a previous record of sharp colicky pain, of partial obstruction, of vomit-

ing, and of some local peritonitis about the region of the liver. In obstruction by foreign bodies the distension is slight; the amount of systemic shock is far less, and the duration of the attack is somewhat longer, than usually obtains in other forms of obstruction. The symptoms frequently denote only partial blocking, the vomiting being moderate in amount and not stercoraceous, and the constipation not being absolute. Except in the case of enteroliths and very large foreign bodies a tumor can rarely be felt.

When obstruction is fully developed and the diagnosis of a foreign body in the causative rôle fairly established, an abdominal section with removal of the foreign body are indicated. If the lodgment is in the rectum, the body should of course be removed through the anus. If operation is absolutely refused, the controlling of pain and violent peristalsis by morphine hypodermically, deep-forced enemata, gentle massage, and feeding by the rectum may be tried. After acute obstructive symptoms have passed off, a continued gentle action upon the bowel, such as is produced by a pill composed of aloin, strychnine, and belladonna, is indicated.

Intestinal Paralysis.

Intestinal obstruction may develop suddenly, and may run to a fatal issue, yet at the autopsy there may be no sufficient cause found for the symptoms observed during life. In some of these cases the muscular coat of the bowel is found intact. The symptoms may depend upon reflex action or upon a general condition of the nervous system; thus severe injury to the testicle, operations about the rectum, or general hysteria have all been accompanied by symptoms of acute intestinal obstruction. These symptoms are usually of an evanescent character, and are promptly relieved by attention to the condition which excited the reflex.

After abdominal wounds, however, tedious laparotomies, or severe contusions in the abdominal region, there may be developed a condition of intestinal paralysis which quickly leads to obstruction, to great distension, and to death from either septic absorption, exhaustion, or peritonitis.

Inflammation or ulceration of the mucous membrane sometimes causes cessation of peristalsis and resultant obstructive symptoms. Denarié gives the history of a case perishing after nearly two weeks of obstinate constipation. There was great meteorism and systemic depression, but no pain or fever. At the autopsy a rodent ulcer of the descending colon was found; beyond this nothing pathological was observed in connection with the intestinal canal, excepting great distension. It is probable that in the great majority of these cases of paralysis the symptoms are dependent upon extension of irri-

tation or inflammation from the mucous or peritoneal coats of the bowel to the muscular layer.

Fatty degeneration of the muscular coat of the bowel may act as a direct cause of intestinal obstruction and death. In one case examined by Jordan the microscope confirmed the fatty change which the muscular fibres were supposed to have undergone. The patients who exhibit this degeneration are those who suffer from fatty changes in other parts of the body. The ultimate paralysis is commonly produced by flatulent distension, but any injury or operation about the peritoneal cavity or pelvis may determine the incompetency of the already weakened muscular fibres. It is universally recognized that in very fat patients symptoms of intestinal obstruction are peculiarly prone to occur after abdominal section.

A purely neurotic paralytic obstruction—such, for instance, as is dependent upon hysteria—would be marked by irregularity in course and the characteristic manifestations of disordered nerve-action. When observed it has been in the persons of hysterical females. The reflex paralysis has also been characterized by short duration and sudden disappearance of symptoms.

The paralysis dependent upon abdominal injury or visceral exposure is that most commonly encountered, since it is this form which occurs after operation. Following abdominal section, the course of the patient may seem satisfactory for from one to three days, when a condition of partial collapse sets in. Unless the patient is very closely watched the onset seems sudden. The pulse is rapid and running, the belly quickly becomes greatly distended, there is vomiting of ingested food or bilious matter, and there is absolute constipation. Pain, though severe at times, does not reach the agonizing intensity characteristic of strangulation. There is no marked tenderness and no characteristic alteration in the temperature. Death seems to occur from heart failure.

Paralytic obstruction dependent upon degenerative changes in the muscular layer of the bowels is usually observed in patients who are advanced in years, and who show atheromatous or fatty change in other parts of the body. There is a preceding history of long constipation, and possibly of occasional attacks of temporary obstruction. The acute onset is usually preceded by obstinate constipation, symptoms of obstruction developing after the taking of an active purge. The symptoms are the same as those characteristic of intestinal paralysis from other causes.

It is particularly in cases of intestinal paralysis that salines have won their reputation. Administered in the first stage, before paralysis has fairly developed, they seem to have the power of re-establishing peristalsis, of restoring tone to the muscular coat of the bowel, and of sweep-

ing from the intestinal tracts the partially-digested matter ripe for fermentation and putrefaction. That the paralysis dependent upon a beginning typhlitis, salpingitis, or any form of local peritonitis has been many times avoided by the prompt administration of saline cathartics cannot for a moment be doubted. Salines, then, should be administered freely in the beginning of this form of obstruction.

If the distension has reached any great development and vomiting has set in, salines are no longer indicted. Absolutely nothing should be given by the mouth; lavage of the stomach should be practised; the rectal tube should be inserted to excite peristalsis and draw off wind from the rectum; the patient should be freely stimulated by whiskey *per rectum* or hypodermically; and the faradic current should be applied with one metal pole within the anus, the other being placed over the motor points of the abdominal muscles. If the distension still increases, multiple punctures into the inflated intestinal loops may be made with an aspirator or hypodermic needle. Finally, if death threatens from septic absorption or over-distension, the abdomen should be opened, the bowel should be incised in as many places as evacuation of its gaseous and liquid contents require, and an artificial anus formed. Should the patient recover from the acute attack, this opening will close spontaneously. The over-distenson being relieved, there is a chance that the tonus of the muscles may be restored. For spontaneous resolution when the meteorism reaches an extreme limit there is not the slightest hope.

Where there is acute pain morphine administered hypodermically is of great service. Strychnine, pushed to its extreme physiological limit, may prove a valuable adjuvant in restoring tone to the paralyzed gut. Stimulating enemata, such as turpentine or asafetida, have at times seemed to accomplish good. Belladonna in full doses is also said to be effective. Other drugs are absolutely useless.

Chronic Obstruction.

This form of obstruction is produced by any cause which occasions a gradual narrowing of the lumen of the bowel. Thus the shrinking of plastic lymph deposited upon the bowel-surface during acute inflammation, cicatricial contraction following ulceration or extrusion by sloughing of an intussusceptum, the gradual blocking caused by matting together of coils of the bowel, or the encroachment upon the lumen of the bowel by new growths, produce the symptoms of chronic obstruction. The bowel above the point of narrowing is commonly dilated and ulcerated. The amount of narrowing is not necessarily indicated by the severity of the symptoms, since frequently death occurs with an opening so large that it is difficult to imagine why the obstruction could not have been relieved.

Chronic obstruction is usually indicated by irregular attacks of colicky pain, noticed a few hours after eating and increasing in frequency. There is frequently vomiting. This is rarely copious, but may become fæcal upon the supervention of an acute attack. Meteorism is not very well marked. Peristalsis can frequently be seen plainly through the abdominal wall. If a new growth causes the narrowing, in addition to the foregoing signs a tumor may be detected.

By careful dietetics and attention to producing regular alvine evacuation, preferably by enemata, operative treatment may be indefinitely postponed. A pill of aloin, strychnine, and belladonna is especially serviceable in promoting peristalsis and preventing accumulation of fæces. This, together with the deep enemata and gentle massage of the belly, is especially the treatment for cases due to fæcal impaction.

When symptoms are progressive, operative interference must be advised, particularly before the onset of an acute attack. The patient is then is a fairly good condition, the surgeon is fully prepared, and a formal and complete operation can be performed with a prospect of success.

If the narrowing is caused by a cancer, the latter should be removed if possible, and the continuity of the gut be restored by lateral anastomosis. If the malignant growth cannot be removed, it should be either switched out of the direct alimentary tract by means of a lateral anastomosis of the bowel above and below the seat of trouble, or, as the most conservative operation in so far as life is concerned, an artificial anus should be formed.

If the narrowing is non-malignant, unless it can be remedied by direct interference it should be excluded by lateral anastomosis. The mortality dependent upon resection is so great that this operation is scarcely justifiable when there is an alternative.

Certainly in the vast majority of cases of acute intestinal obstruction it is absolutely impossible to determine the exact mechanical cause which is exciting symptoms. These are very much alike, from whatever cause the obstruction arises. In the preceding pages there has been given a brief review of the salient features of the various forms of obstruction and of the special treatment applicable to each form. It seems fitting that there should be a general review of the various methods of treatment proposed for the cure of this class of cases.

Diet and Medication.—Neither food nor drink should be given by the mouth during the continuance of acute obstructive symptoms. This is not merely because there can be no digestion and no absorption, but because by taking alimentation into the stomach fresh matter is supplied for decomposition and fresh impetus is given to the exhausting vomiting. In one case of acute obstruction I withheld

food for six days. The patient recovered, showing no marked emaciation as the result of her long fast.

Beef peptonoids, peptonized milk and eggs, and stimulants should be administered by the rectum. The thirst may be relieved by gently injecting one or two pints of warm water into the lower bowel. If the heart shows signs of flagging, especially if collapse threatens, by means of a fountain syringe and a fine canula 3 to 6 ounces of whiskey, dissolved in 1 or 2 pints of warm sterile saline solution, may be thrown by gravity into the loose cellular tissue of the loins or the buttocks. By gentle friction over the seat of injection rapid absorption is obtained. Hypodermic injections of ether, frequently repeated, are peculiarly applicable to this condition. Digitalis does not give satisfactory results. Against heart failure whiskey is the main stay, and must be pushed until its physiological effect is produced. The rectum may also be used for the absorption of whiskey, but in this case the drug should be diluted with at least six times its bulk of water, since acute inflammation of the mucous membrane has been produced by concentrated solution.

Opium and belladonna are indicated when pain becomes so intense and vomiting so frequently repeated that the patient's strength is rapidly exhausted. They should be given together, and preferably in the form of alkaloids by hypodermic injection.

Strychnine is of service in conditions of profound nervous shock and in paretic states of the bowel. To be of service it must be pushed till its physiological effect is produced.

Purgatives are to be avoided.

Intestinal antiseptics, such as salicylate of bismuth, β-naphthol, salol, and boric acid, may be employed if they do not increase the vomiting. They are particularly serviceable when given in the course of lavage.

Lavage of the Stomach.—This treatment, originally advocated by Kussmaul, has received the highest clinical indorsement. Its effect is direct and readily understood. It mechanically removes a large quantity of putrid septic matter which otherwise would be slowly and laboriously regurgitated by violent muscular efforts, thus still further weakening an already debilitated patient. It assists Nature in her eliminative efforts, and almost without exception produces an immediate improvement in the patient's condition. Indeed, there is so great an amelioration of symptoms that this procedure is utterly condemned by some surgeons as producing, like opium, a seeming improvement not warranted by the condition of the bowel at the seat of obstruction, and thus leading to a postponement of operation.

In some cases it produces not only relief, but is absolutely curative; Mahnert reports several cases of cure. Even where death is inevitable it is productive of such relief that it may be employed if nausea

and vomiting are well marked. Cursehmann ranks washing of the stomach next to opium as a palliative and curative agent. Nothnägel and Gerster commend this procedure, as do indeed all surgeons who have fairly tried it.

Either plain water may be used or normal saline solutions or mild antiseptic lotions. Since there is a patulous condition of the pylorus, the weak antiseptic solutions are particularly indicated, as by becoming mingled with the intestinal contents further fermentation is retarded or entirely prevented. These injections should always be made with hot solutions (106° F.), and should be repeated in accordance with the severity of the vomiting and the character of the eructated material.

Enemata.—In the use of enemata there is more confidence than in all the other palliative means of treatment combined. Though especially applicable to intussusception, paralysis may be benefited by the stimulus thus given to peristalsis. In chronic obstruction dependent upon impacted fæces or upon narrowing in some portion of the colon the use of enemata is practically the only palliative measure which gives any hope of success.

In making these injections certain points of cardinal importance must be regarded. When the injection is given for the purpose of exciting peristalsis, as in the case of intestinal paralysis or fæcal impaction, it should be administered as rapidly as possible, and should be either cold or very hot. Its beneficial effects will be favorably modified by the addition of turpentine, asafœtida, or other stimulating medication.

When the injection is given for the purpose of mechanically overcoming obstruction, as in the case of intussusception, the liquid should enter the bowel by a gradual, steady flow. The temperature of the injected liquid should not differ greatly from that of the body. The pressure should be uniform and long continued, starting at two pounds (elevation of the reservoir four feet), and if necessary gradually increasing to eight pounds (elevation of the reservoir sixteen feet). At the most not more than three-quarters of an hour should be spent in attempting to force the liquid past the seat of obstruction.

The danger of rupturing the bowel must be borne in mind. In every case where beginning mortification is feared—that is, where the symptoms have been very acute and have lasted for upward of three days—the danger of forced injection is so great and its probable efficacy so slight that this procedure should give place to operation. Under any circumstances there is some risk in the employment of eight pounds of pressure, though this is far within the bursting strain of normal gut.

In view of the many successful results following even imperfect attempts at this method, this risk is justifiable in suitable cases, provided preparations are made for immediate abdominal section should

symptoms characteristic of rupture of the bowel appear. The first attempt at reduction by injection should be so thorough that the physician can feel assured that the particular case of obstruction under treatment is not amenable to this method of reduction. At the first effort the circumstances are all more favorable for cure than at any subsequent time, and more force and perseverance are justified. There are many recorded cases showing that second and third attempts at reduction have succeeded when the first failed; this, however, was undoubtedly due to the greater thoroughness with which the latter efforts were made. These forced enemata should always be made by means of the fountain syringe: it is impossible to gauge the amount of pressure exerted by the Davidson or other pumping syringe. I know of three cases where injections administered by the Davidson syringe resulted in rupture of the bowel and speedy death.

Electricity.—In paralytic distension and obstruction the use of electricity has been followed by brilliant results. Thus, Auffret records a case which entered the hospital with great abdominal pain, tenderness, meteorism, and bilious vomiting. Abdominal facies was marked, the thighs were flexed upon the body, the pain was located about the umbilicus, the dilated intestinal loops were clearly outlined through the parietes. The pulse was scarcely perceptible, the temperature was subnormal. The following day all the symptoms were exaggerated and death seemed inevitable. The poles of a faradic battery were placed, one over the abdominal parietes, the other within the rectum; the application was continued twenty minutes, and was carried to its maximum intensity, when the patient experienced a sudden jar, accompanied by a feeling of intestinal displacement. Immediately there was a free evacuation of gas and fecal matter. The patient rapidly convalesced.

When it is uncertain whether obstruction is caused by paralysis or by mechanical blocking, the application of electricity by means of the faradic battery should be given one thorough trial, preferably by means of a metal electrode carried into the rectum, the sponge electrode being applied to the belly-wall. As a means of applying the current still more directly Heard advocates filling the rectum with saline solution and introducing the metal electrode into this.

It certainly cannot be claimed that even the majority of cases of paralytic obstruction will yield to electric treatment. That some do is indisputable. Since this agent can do no harm, and since little time is consumed in its application, and in some cases its results are curative, it should be given a fair trial in suitable cases.

Gaseous Injections.—The injection of air or gas as a means of locating and of overcoming intestinal obstruction has lately been warmly and nearly universally commended. The indications for the

use of air-insufflation are practically the same as for the employment of aqueous injections. It cannot, of course, be denied that gas diffuses more readily than water, and hence that it may pass an obstruction that would effectually bar the ingress of the latter. The pressure, however, is not so readily regulated, and, as in certain cases the weight of the water seems to be an important factor in the accomplishment of the cure, insufflation is not so valuable a method of treatment as injection of liquids. The cause of frequent failure in the use of insufflation, as in the employment of liquids, is dependent upon an imperfect method of applying this treatment. Any injection into the bowel causes a spasmodic resistance and effort at extrusion. This is increased if the pressure is constantly varying. Spasm ultimately yields to steady, continued pressure, even though this be slight. If obstruction is to be overcome, the gas must reach the seat of trouble, and it is far safer to accomplish this by moderate continued pressure, continued for thirty or forty minutes, than by rapidly increasing the pressure if in five or ten minutes no results seem to follow.

Reported cases of rupture which have occurred during insufflation show that this method of treatment is not without danger. A manometer should always be attached to the injection-pipe for the purpose of accurately ganging the amount of pressure employed.

Metallic Mercury.—The use of metallic mercury as a means of overcoming obstruction is rare at the present day. Yet this treatment is warmly advocated by Matignon, who states that when employed in cases of ileus following fæcal accumulation the metal becomes finely divided, and so coats and penetrates the obstructing mass that the latter is loosened and its discharge is facilitated. Matignon states that in no instance is mercurial poisoning produced; that pain and vomiting are quickly relieved; and that frequently, after all other means have proved absolutely fruitless, a prompt evacuation of the bowel contents follows this treatment. Mercury has also been employed as a rectal injection, in the hope that by its weight invagination might be reduced. Heard injected one pound into the rectum of an infant aged five months, and then inverted the child, hoping by this means to cure an intussusception.

The special applicability of mercury would seem to be in cases of fæcal impaction where other means of treatment have not been successful.

The Rectal Tube.—In the beginning of paralytic distension the rectal tube is of distinct value. It excites peristalsis, and by overcoming the resistance of the sphincters relieves tension by allowing large quantities of gas to escape. The sharp angularities of the sigmoid flexure and its free mesenteric attachment prevent the point of the tube from passing beyond this portion of the gut; hence there is

nothing gained by passing the tube deeper than five or six inches. The attempt to reduce an invagination or volvulus by a stiff tube is not to be commended.

Injections of Ether.—Ether has sometimes been injected into the bowel as a means of encouraging peristalsis, and in cases of invagination as a means of dilating the lower bowel by its vaporization and thus effecting reduction. Clause reports two successful cases in which relief was immediate upon the injection of a pint of a 3 per cent. solution of ether. This treatment is, however, followed by a local inflammation so violent that it at times excites a pathological condition as dangerous as that for the cure of which it is advised.

Position.—In medical literature there are a number of cases recorded in which marked symptoms of obstruction were immediately overcome by either inversion of the patient or inversion combined with shaking. The knee-elbow position persisted in for some time has at times relieved symptoms.

Abdominal Massage.—Hutchinson highly commends kneading of the abdomen under an anæsthetic and in combination with injections as a treatment for nearly all forms of intestinal obstruction.

In the obscurity which always surrounds cases of obstruction the judicious application of massage is purely a matter of chance. Not only may it be hurtful in cases of peritonitis, but it may immediately determine the rupture of a greatly distended and congested loop of gut. It is easy to see how massage may be beneficial in every form of acute obstruction, but to apply this method so that it will necessarily produce the result desired is an impossibility.

When intussusception is seen early, the effect of injections may be materially aided by massage, and in cases of fæcal impaction uncomplicated by peritonitis this method of treatment has given good results.

The application of ice to the abdomen and the administration of leaden bullets by the mouth, both treatments which have been warmly advocated, are mentioned only to be condemned.

Puncture of the Abdomen.—In cases of meteorism sufficiently developed to embarrass the respiratory function, Ogle advocates one or more punctures into the distended gut by means of an aspirator or hypodermic needle, and the withdrawal of as much gas as possible. These punctures should be made in the most distended part of the abdomen. After all the gas that can be drawn out is evacuated, a few drops of carbolic solution or iodoform oil should be injected through the needle to disinfect the punctured tract.

In excessive and dangerous tympany punctures may be of distinct service. They should be made by means of a fine needle and under most careful antiseptic precautions. The needle should be driven in with a sudden violent thrust, the thumb guarding against too deep

penetration. This lessens the danger of the bowel being pushed before the point of the instrument, rather than being penetrated by it. A wire should be provided for cleaning the canal of the needle in case this becomes blocked. As many punctures should be made as are necessary for the entire relief of pressure symptoms. If the muscular coat of the bowel retains the slightest amount of tonicity, the puncture will be immediately closed, since as the gut contracts the relative change in the opening through the various coats at once occludes the minute canal. If the gut is in a condition of absolute and hopeless paralysis, fæces may leak through even the minute opening made by a hypodermic needle. The condition in these cases, however, is so desperate that it is a question whether any means offers the slightest hope.

Enterostomy and Colostomy.—By these terms is meant the establishment of an artificial anus in the small and in the large intestine respectively. The operation, when it concerns the small intestine, consists in making an incision in the right iliac region and securing the first distended intestinal coil which presents to the entire circumference of the peritoneum about the parietal wound, the peritoneal and skin surfaces of which have been united by a continuous suture. The gut is then incised and its contents evacuated. This operation is one which may be indicated when the surgeon is not called to see a case of obstruction until the patient's general condition is so bad that formal operation is contraindicated. In these cases it has often succeeded in saving life. The relief afforded by the artificial opening frequently allows Nature to overcome the obstructions in the intestinal canal. If this occurs, the fæcal fistula will close spontaneously or may be closed by plastic operation.

Colostomy, or an artificial anus opening into the colon, will be indicated in inoperable cases of acute obstruction located in the colon. It is rarely performed except for the relief of chronic obstruction, such as that which occurs in cases of cancer of the rectum. As far as statistical study goes, the lumbar operation is to be preferred, though for convenience to the patient an inguinal operation is much better.

Abdominal Section.—By this term is implied a formal opening of the abdominal cavity for the purpose of discovering the seat and nature of the obstruction, and of restoring the continuity of the alimentary canal. Where gangrene or other local condition necessitates resection of the gut, lateral approximation gives far greater promise of success than either end-to-end suture or invagination.

In all cases of acute obstruction abdominal section should be immediately resorted to after one thorough attempt at restoring the continuity of the intestinal tract. The mortality from this operation as gathered from statistics is exceedingly discouraging. This is entirely

because operation is too long postponed. Perhaps in the majority of cases the surgeon is not called in until the patient is actually dying. During and after operation heat preservation and combating of shock are most important indications. The operation should be performed as quickly as possible. Not more than half an hour should elapse between the opening and the closing of the belly. Where more time than this is required, it will usually be better to form an artificial anus, rather than to attempt to restore the continuity of the gut. Of course strangulation must be relieved, and the distended and paralyzed gut must be emptied of its contents. At the completion of the operation shock will be relieved and a natural position of the intestines will be favored by copious flushing out of the peritoneal cavity by 0.7 per cent. sterile saline solution at a temperature of 106°.

The whole treatment of acute intestinal obstruction may be briefly summarized by stating that in invagination and in intestinal paralysis only should operation be delayed. In invagination the delay should not be longer than the time required to note the effect of one deep-forced injection. This is a matter of a few hours at most. Internal paralysis should be treated in accordance with its cause. In general, the knife and hot saline flushing should be held as the last resort.

In obstruction due to strangulation, volvulus, congenital malformation, or foreign body the first thought should be operation, nor should any other method of treatment be considered for a moment.

PERITONITIS, APPENDICITIS, AND PERI-TYPHLITIC ABSCESS.

By ROSWELL PARK, A. M., M. D.

PERITONITIS.

General Considerations.

Peritonitis as a disease has had an identity of its own only since the beginning of the present century. Previous to that time it had no independent recognition, and while the gravity of the condition had not been overlooked, its most prominent symptoms had been regarded either as accidental or secondary.

The disease may be regarded from the anatomical, the clinical, and the pathological point of view, and according to each of these it is possible to group cases in such a way as to classify them. Taking first the clinical classification, we may make the following divisions: 1. Idiopathic; 2. Consecutive; 3. Perforative; 4. Traumatic; 5. Chronic; 6. Tubercular; 7. Malignant; 8. Latent; 9. Intra-uterine and infantile.

Idiopathic Peritonitis.—While it is a question whether a complete inflammatory disturbance can ever occur without the presence of micro-organisms, still there are apparently certain forms of peritonitis in which these do not figure. The so-called "idiopathic" form is frequent in the course of chronic Bright's disease and of scurvy. In both of these conditions there is undoubtedly a toxæmia, but its exact relationship to the peritoneal inflammation is unknown. The same is true of acute rheumatism, and an acute rheumatic peritonitis is possible, though very rare. Why, in the course of this disease, the peritoneum and pleura should suffer so seldom and other serous membranes so often we do not know. Malaria also may cause acute peritonitis, and many cases of this disease in patients suffering from chronic malarial poisoning will not yield without the administration of quinine. A so-called menstrual form of acute peritonitis is also described in which probably exposure to cold plays a part.

The Consecutive Form of Peritonitis is due to an extension of inflammation from surrounding parts, and most frequently from the abdominal viscera. It appears, furthermore, that this occurs more

often from the hollow than from the solid viscera. It is, for example, much more common as an extension from the stomach, intestines, gall-bladder, uterus, or Fallopian tubes than from the spleen, liver, kidneys, pancreas, or mesenteric lymph-nodes. It is consecutive to parietal inflammations, as from erysipelas, carbuncle, or burn of the abdominal wall. It also succeeds inflammation of the thoracic viscera, as pleurisy, pericarditis, pulmonary abscess, empyæma, hydatid cyst, or even phrenitis. It follows infectious embolism of branches of the abdominal aorta, and phlebitis and periphlebitis of the abdominal or pelvic veins. It comes after urinary infiltration from any cause; but perhaps the most common instances of consecutive peritonitis are met with after strangulation of the intestine or acute obstruction from any cause, and from the results of the puerperal condition. So far as the former are concerned, a small strangulated hernia, an invagination of the bowel, a fæcal impaction producing obstruction, are equally favoring anatomical conditions. In any one of these instances the process consists of stasis, exudation, and infection. Of the condition of metro-peritonitis it must be said that it is perhaps more common even after abortion or miscarriage than after delivery at term. This form is treated of at length in works on gynæcology and obstetrics, and needs no further attention here.

The Perforative Form.—That peritonitis invariably ensues after escape into the peritoneal cavity of any secretory or excretory material which Nature has intended to keep out of it is well known. Such attacks are for the most part fatal, although in rare instances the inflammation is circumscribed and recovery may ensue. Perforation may occur from the stomach, as in cases of gastric ulcer, and these are the cases in which the inflammation is most likely to be localized. It may occur from the intestine. The majority of these cases are post-typhoidal, when the disease assumes a fulminating type and patients die very rapidly. It may be the result of post-dysenteric lesions, when there has been a diphtheritic form of enteritis, in which there is always a possibility of sloughing of a portion of the intestinal wall. It may be a result of gangrene of the intestine, due to strangulation, a sloughing portion giving way and permitting fæcal extravasation. When a hydatid cyst ruptures into the peritoneal cavity, it nearly always causes acute peritonitis, its contents being apparently toxic. Perforative peritonitis may also result from rupture of an ureter, perhaps due to the presence of a calculus, or to rupture of the bladder or gall-bladder, or of any abscess—for example, perityphlitic—in the neighborhood of this membrane.

The onset of cases due to perforation is very acute, and is followed usually by sudden meteorism, with profound collapse and speedy death.

The Traumatic Form.—This comprises all cases of peritonitis due

primarily to trauma, whether the peritoneum has been opened or not. Thus, violent contusions upon the abdomen not infrequently provoke it, and crushing injuries which produce rupture of the liver or the bladder or of the kidneys are frequently followed by it. The most common injuries which produce it are penetrating wounds—lacerated, punctured, and gunshot. This form of disease is nearly always septic and sometimes putrid. In one sense it might also be proper to regard cases which are due to strangulation of the bowel as traumatic, since the actual condition is not widely different.

Chronic Peritonitis.—This form is perhaps more often due to a condition of chronic Bright's disease than to any other one factor. It is characterized anatomically by a much-thickened and opaque peritoneum, within which more or less adhesion of contents has occurred. The amount and the extent of these adhesions in some instances is wonderful. Cases are on record in which all the viscera were so knitted as to be inseparable (*peritonitis obliterans seu deformans*). This clinical form of the disease is characterized by the absence of acute manifestations and the tendency to fibrinous exudate, which often forms adventitious membranes, which latter constitute superimposed layers and cause the peritoneum to appear much thicker than it really is. This is especially the case about the liver, and it is worth while to remember that in cases of perihepatitis the thickened investment of the liver is in some measure due to this cause.

These new membranes may divide the general peritoneal cavity into a few or numerous chambers, so that when the abdomen is opened it appears to be filled with cysts. Inasmuch as fluid may collect in each of these chambers, the resemblance is more striking. Careful dissection and examination will clear up all doubt. It is characteristic of chronic peritonitis that the mesentery is shortened and that the actual length of the intestine is diminished. Sometimes it is reduced by several feet and its diameter is contracted. This is the result of cicatricial and atrophic changes, which bespeak a long duration for the disease.

This form is nearly always accompanied by marasmus, which may be explained by the anatomical condition just alluded to and by more or less ascitic collection of fluid. Sometimes the ascites is very pronounced. On the other hand, the peritonitis itself is sometimes the result of the ascites due to other causes, since the distension of the membrane by fluid seems to lead to chronic inflammatory processes in its texture. The former condition corresponds with the "idiopathic dropsy" of many of the older writers. From what has been said it does not follow that this form is necessarily a chronic process *de novo*. Not infrequently it is the relic of an acute attack.

Tubercular Peritonitis.—Like tubercular disease elsewhere, this may be primary or secondary. The slow forms are characterized by

the condition of the peritoneum described in the preceding variety, plus the peculiar dotted appearances, perhaps even nodular, which tubercular deposits produce. In many of these cases, especially the slowly progressing ones, the omentum will be found to have undergone distinct caseous alteration. The abdominal cavity may contain serum clear or turbid, pus or purulold material, or recent or old blood, since hæmorrhage from the affected surfaces is not uncommon. Tubercular peritonitis assumes a proliferative type when time is afforded, and is the cause of numerous adhesions. It may be acute—in fact, almost as overwhelming in its onset as tubercular meningitis—or it may run a very slow and irregular course. Its symptoms are vague and obscure. It is characterized, first, by general ill-health, which later becomes pronounced marasmus accompanied by diarrhœa, especially if the intestines be ulcerated. Unless pus or fluid be present the abdominal walls are retracted. Two very valuable signs of this condition are induration and nodulation of the omentum, when it can be felt, and reddening and thickening around the umbilicus, due to extension of the disease along the obliterated umbilical vessels.

Malignant Peritonitis.—Less than half of these cases are really primary, the major portion being secondary or metastatic. A primary miliary carcinosis is known, but is very rare; as a secondary condition it is less so. Circumscribed cancer of the peritoneum is now and then met with, and occasionally the peritoneum is filled up with a mass of colloid material, to which the name of colloid cancer is given; but it is really due to colloid degeneration of medullary carcinoma or small round-celled sarcoma, which are most likely to occur primarily in the omentum. This form is characterized by mildness of symptoms, by a progressively downward course, and sometimes by hæmorrhages which may be the actual cause of death. Recent investigations make it likely that in cases of widespread cancerous disease there is a toxæmic condition engendered, as the result of the cancerous growth, by unknown substances produced by the abnormal tissue-changes.

The So-called Latent Forms of Peritonitis.—Every practitioner of wide experience meets with fatal cases in which pus or other evidences of diffuse or local peritonitis are found, but in which during life such condition had scarcely been suspected. These are perhaps more common after the form of local peritonitis to be spoken of later as appendicitis. This form of latent disease is indeed virtually always characterized by the presence of pus, and is simply evidence of the fact that the disease had not been recognized, the failure of recognition being due sometimes to the profoundness of systemic poisoning, sometimes to the existence of other and apparently more serious disease; and sometimes it is to be explained by the fact that when pus forms very rapidly the exquisite sensibility of the peritoneum is apparently lost. The

latent type of the disease deserves no place in pathological classifications; it is to be regarded purely as a clinical curiosity.

Intra-uterine and Infantile Peritonitis.—That congenital stenosis of the intestine may lead to a fœtal peritonitis has been shown by Virchow and others. It is usually rapidly fatal from the nature of the condition which primarily produced it. An infantile form has also been distinguished which occurs shortly after birth, and is for the most part due to causes arising from the umbilicus, such as inflammation, lymphangitis, and gangrene of the umbilical vessels, or to umbilical hernia. It is most common in connection with similar disease in the mother or the existence of the disease in endemic form. It is for the most part of septic type, possibly even putrid.

Such is a classification of cases of peritonitis based purely upon their clinical form. The *anatomical* classification is very simple: 1. The general or diffuse form, which has already been sufficiently considered; and 2, The circumscribed or localized form. The second variety may merge into the first as congestion is excited and exudate transplanted by means of the respiratory and peristaltic motions to which the abdominal contents are subjected. Perhaps the most common examples of circumscribed peritonitis are met with upon the bowels and about the cæcum. The traumatic form clinically is frequently also represented by the circumscribed form anatomically. A very rare form of the disease is that which is limited to the cavity of the lesser omentum, which for the most part is consecutive to disease of the pancreas. Virchow also has described a peritonitis *chronica mesenterialis et omentalis.*

Localized peritonitis is also frequently due to fæcal accumulation or to the presence of cystic or solid tumors.

The pathological distinction between the various forms of peritonitis is one of great interest. The following classification is modelled after that of Bumm:

1. Aseptic. Usually local, not always. Characterized by hæmorrhagic or fibrinous exudate with strong adhesive tendencies.

2. Infectious. *a.* Staphylococcus and streptococcus forms, the latter being the most rapidly fatal. These are usually post-puerperal. *b.* Colon infection. Due to the Bacillus coli communis. *c.* Septic. Characterized by pus instead of ichor, and by acute onset with chill and pyrexia. *d.* Putrid. Usually the result of perforative forms.

3. Specific, including tubercular, actinomycotic, malignant, and the gonorrhœal, if there really be such specific forms.

Taking this up a little more in detail, it must be said of (1) the aseptic form that it is at least rare; but experiment has shown that it is possible to provoke congestion and exudation, or even hæmorrhage into the peritoneal cavity, which shall be accompanied by certain symp-

toms and shall terminate by resolution or by adhesion between surfaces. The reader who is interested in this aspect of the question is referred to a paper by the writer,[1] being No. 5 of the Mütter Lectures of 1890–91.

2. *a*, *b*, and *c*—the *infectious* forms. It has been shown, experimentally, that pyogenic organisms produce peritonitis, for the most part naturally, when introduced in excessive amount, or when some other substance prepares the soil and assists their penetration into the deeper layers, or especially when some wound of the abdominal wall favors localization of the infection. The streptococcus and staphylococcus cases are hence usually met with after parturition or abortion. On section there is found a thin, purulent, odorless exudate, or if late this may be thick and creamy. Early in the disease this exudate is extremely infectious; it loses its virulence as the disease progresses or in proportion to its slowness.

Peritonitis due to infection from the colon is a variety but recently constituted by investigations by Professors Welch and Councilman of the Johns Hopkins University. From their investigation it appears that under certain conditions not yet completely recognized the common colon bacillus escapes from its ordinary habitat, and is capable of producing intense and even fatal disturbances in the peritoneum. It is found now within the lymph-nodes and the liver, and is thus seen to have migrated widely beyond its normal limits. This form occurs not infrequently after operation, but may be purely idiopathic or consecutive to dysentery, etc.

The *putrid form* occurs most commonly after operation for perforation. It begins without chill, but with fever which gradually runs higher, and is characterized by a putrid, foul-smelling exudate. It is much less infectious than the other forms, and contains a mixture of micro-organisms, many of which are not known to be pathogenic. It is the result in large measure, if not primarily, of putrefactive organisms. Its pyrexia is due chiefly to ptomaïnes which they produce.

3. Of the *specific forms*, the tubercular and malignant have been already sufficiently considered. The actinomycotic is a curiosity which need not detain us here. We hear a great deal of a gonorrhœal form of peritonitis which is due to extension of gonorrhœal infection through the tubes. Strictly speaking, this is probably an impossibility, so far as a pure type of gonorrhœal infection is concerned. I have taken pains in another place to show that most instances of gonorrhœa are mixed infections, and have also called attention to the fact that gonococci by themselves are not pyogenic. Even in inflamed and distended joints, so long as gonococci alone are present there is no pus, this

[1] *The Annals of Surgery*, July, 1891.

being due solely to a contamination with staphylococci or streptococci; and so, without questioning the frequency of peritoneal complications or sequelæ of gonorrhœal disease, we must relegate these cases to the staphylococcus or streptococcus forms, where they really belong. This is hardly the place for an extended discussion of this aspect of the general topic, or we would gladly consider it at much greater length.

Symptoms.

The first symptoms or signs of acute peritonitis are usually one or more chills or rigors, followed by pyrexia, which may reach 104° or 105° F. High temperature is usually preserved throughout the course of the disease, although it occasionally falls before death, and sudden fall is to be regarded as a bad sign. It is also worth noting that the body temperature sometimes rises for a few hours after death. Almost from the outset the patients display an anxiety of countenance significant of serious disease, and sometimes a condition of prostration and shock is present almost from the beginning, which may amount at any time to collapse. The most characteristic feature of this disease is the abdominal pain or distress which is complained of, and usually described as cutting or lancinating, which is always aggravated by change of position or by such involuntary actions as coughing, and also by any excess of peristaltic action. The abdominal walls become rigid, at least at first, and the semilunar and transverse lines very prominent. The legs are usually drawn up, in which position slightly more comfort is afforded to the patient. Along with pain goes exquisite sensitiveness to pressure, which often prevents the application of such local measures as might otherwise give some relief. The breathing becomes much more rapid than normal, and of the thoracic type. Sudden suspension of pain is generally regarded either as a sign of impending death or of the presence of pus, which amounts to nearly the same thing, sensibility being obtunded as pus forms. After a short time abdominal rigidity gives way to abdominal paresis, and this is followed by characteristic meteorism and tympany, which are more likely to occur if in a given patient the abdominal muscles are habitually relaxed. Along with this condition the diaphragm is pressed upward and the thoracic viscera displaced.

Almost from the beginning there are frequent, perhaps nearly constant, nausea and vomiting, the stomach rejecting anything which may be put into it, and sometimes returning the contents of the intestine by retrostalsis. This sign, commonly so pathognomonic, is occasionally absent or insignificant. In a majority of instances the bowels are costive and peculiarly sluggish. Occasionally—and this most frequently in the puerperal form—there is diarrhœa. Micturition is difficult, because it causes pain, especially when the pelvic peritoneum

is involved. Hiccough is occasionally noted, and is commonly regarded as a bad sign, since it usually precedes death by only a short interval. Throughout the course of the disease the tongue is furred, sordes collect on the teeth, there is a hot and dry skin, and the patient complains, next to pain and nausea, of tormenting thirst. Friction between roughened peritoneal surfaces may sometimes be detected with the stethoscope or by the hand laid upon the abdomen. If fluid forms in large amount, signs of its presence may succeed to those of meteorism, and it is rarely possible to get fluctuation or succussion on account of the meteorism.

In extreme cases, and shortly before death, to the foregoing signs are added sometimes more or less delirium, merging into coma with cyanosis, due to embarrassment of circulation and respiration. Retention of urine, with paralysis of the rectal sphincter, is usually also to be noted. The most frequent complications of peritonitis, which is not itself consecutive, are pleuritis, pericarditis, and jaundice.

The *diagnosis* of acute, general, or even local peritonitis is not difficult. We may have to distinguish it possibly from colic, which we can do by the facts that in the latter the pain is very intermittent, that even when the patient suffers most intensely he is restless, and that pressure and friction give relief. The disease may be simulated in the hysterical condition by exaltation of cutaneous sensibility. In such cases we will observe the presence of other symptoms, as well as the existence of many inconsistencies in the patient's account of the case. There is also likely to be a history of globus or other hysterical manifestations. Rupture of small vessels or aneurisms and embolism of branches of the abdominal aorta, or thrombus of large venous trunks, with phlebitis, etc., occur rarely, and may be at first mistaken for acute peritoneal inflammation. Careful observation extended over a few visits will guard against error and permit a differential diagnosis to be made.

Treatment.

In the writer's estimation the treatment of a given case of peritonitis should depend in large measure upon its characteristics and causation. Following the conventional clinical distinction, without reference to minute pathological distinctions, let us first speak of the so-called idiopathic cases, which are those following, perhaps, exposure to cold, mild abdominal contusion, occurrence of dysentery, and enteritis. For these—as in fact for all—physiological rest of surfaces covered by the peritoneum is above all indicated, and should be secured, so far as the case permits, by the drugs and measures to be mentioned. Such rest is to be obtained, first of all, by entire absence from laxative or purgative treatment, the bowels being opened, perhaps, at the outset by a laxative enema, after which cathartic measures are to be

entirely abstained from. This is a canon in the treatment of such cases which no one can safely violate. If it seems that the case is due to causes arising in the stomach or the intestinal canal, absolutely no food should be given, though possibly pellets of ice may be administered, and if necessary small nutrient enemata, simply for the purpose of affording nourishment and assuaging thirst. Nourishment may also perhaps be administered with suppositories of gluten or some substitute. Local relief will usually be afforded by hot applications and turpentine stupes, unless the abdominal surface be too tender to tolerate their weight. Pain is also sometimes relieved by leeches, though their application will serve only to frighten sensitive patients. The use of ice poultices, as recommended especially by Niemeyer, has not found general favor in this country, and if resorted to at all can only be carried out during the very early stage of the disease.

The sheet-anchor of the physician, in cases such as are alluded to here, must be opium or its derivatives, according to the system first recommended by Graves in 1822, and very generally associated in this country with the name of Alonzo Clark. When resorted to for this purpose and in sufficient amount, opium will be found to furnish sufficient anodyne, tonic, laxative, and generally commendable virtues to make all other medication, for the time at least, unnecessary. The question now is not one of dosage, but one of effect; and it has been found that patients suffering from peritonitis acquire by virtue of their disease a tolerance for this drug which is simply astonishing. It must be given, not in small but in large and frequently-repeated doses, until patients are absolutely free from pain and put comfortably at rest. Under its influence nausea and vomiting will subside, abdominal distension decrease, tenderness be allayed, and faecal evacuations take place naturally and almost regularly. The amount of opium administered is to be a purely secondary thought. Thirty, fifty, or more grains of opium may be given in a day with salvation to the patient, when perhaps with less the case would have resulted fatally. A girl of thirteen years recently under the care of one of the writer's colleagues took 19 grains of morphine in twenty-four hours, with perfect relief from distressing symptoms, with almost natural evacuations of the bowels, and with satisfactory and speedy recovery; up to the time of her sickness she had never had a grain of an opiate in any form. Nor need one fear from this tremendous dosage the subsequent formation of the opium habit, providing proper care and management be exercised.

While opium, then, is the mainstay in this disease, it will not be amiss if mercurial ointment be applied over the abdominal surface, if intense meteorism be relieved by passage of the rectal tube or by puncture with a fine aspirating needle properly sterilized before use,

nor if in desperate hiccough small doses of cocaine be administered by the stomach, or small amounts of chloroform be inhaled.

Treatment of Septic and Traumatic Cases.—Cases which follow operation, injury, or the puerperal state belong both clinically and pathologically to a different category, and may call for treatment widely different from that already indicated, although in candor one must say that opium has been found sufficient for many of these. In that form of septic peritonitis known commonly as puerperal it has been found advantageous, and sometimes even life-saving, to administer at the outset a large, even an enormous, dose of some laxative or purgative, such as calomel or Epsom salt, by which free purgation, almost to the point of collapse, has been brought about. Explanation of such extremely opposite lines of treatment is to be found in the peculiar capacity of the peritoneum for the absorption of liquids, even when these are essentially septic. Experimental pathology has proved its astonishing capacity in this respect, and not infrequently vigorous catharsis, followed by such physiological rest as opium will then ensure, has met with most pronounced success. Although the name of Lawson Tait is associated with this plan of treatment, it dates back almost to prehistoric times.

Should, however, the sepsis be due to distinct traumatism or to appendicitis, pyosalpinx, suppurating gall-bladder, or other similar disease in or near the abdominal cavity, the case at once becomes one for the surgeon, whose duty it now is to open freely to learn if possible the source of infection, to meet any present indication for drainage, possibly to irrigate the peritoneal cavity either with warm distilled water or Thiersch's solution, to close the abdominal wound, and then drain. The same is true also should this condition supervene after surgical operation. A distinctly different though parallel condition is the putrid peritonitis due to perforation of an abscess, or after typhoid fever or malignant ulceration or perforating wound of the intestine. Here the patient has scarcely one chance in a thousand of recovery unless laparotomy be done, with careful search for the source of infection and removal or repair of the same, and careful removal of products of infection from every part of the abdominal cavity. Considerations of this kind open up the subject of abdominal section for typhoid perforation, which Mikulicz was the first to perform, although without success, for perforative appendicitis, which has been followed by success in the hands of American surgeons; and also for the results of gunshot and stab wounds of the bowels or stomach, with which, again, the names of American surgeons are especially linked.

Laparotomy has been done nineteen times for perforation during typhoid, with four recoveries. (December, 1891.)

Careful consideration of these topics, however, takes one too far

away from the question of general therapeutics, and too deeply into the domain of special surgery, to warrant more than their mention here.

Treatment of Chronic and Tubercular Peritonitis.—Operative treatment of these conditions is based for the most part, we confess, upon empirical grounds. It is well known, for instance, that a condition of abdominal dropsy due to chronic peritonitis, which itself is due to the presence of some tumor or irritating foreign body, has subsided after the performance of abdominal section and the removal of the offending substance. Indeed, ascites without ascertainable cause has been known to subside after laparotomy, the reason for which is unexplained, and advantage has been taken of these inexplicable facts to erect into the dignity of an indication a series of a few accidents, and to formulate rules for laparotomy for the indefinite purpose, yet sometimes successful, of improving or curing these obscure cases.

Tubercular peritonitis especially, it is now well known, can be sometimes combated by the mere performance of a small abdominal section with or without drainage, the operation itself apparently having an alterative effect for which no satisfactory reason has yet been ascribed. Among gynæcologists, however, it has now attained the dignity of special mention and special chapters in their treatises, and we have the statement of more than one of them that all the active manifestations of a tubercular peritonitis, where the diagnosis has been formed by ocular inspection of the peritoneum, have been known to subside temporarily, even apparently permanently, after opening, perhaps with irrigation and drainage, and closure of the abdominal cavity. Here too we must refer the interested reader to the monographs and treatises of the specialists for further information.

APPENDICITIS.

General Considerations.

Under the general term "Appendicitis" are now comprehended the conditions formerly recognized under the names typhlitis, perityphlitis, paratyphlitis, extra-peritoneal abscess of the right iliac fossa, and perhaps certain other terms now more or less obsolete; for all of which the still more recent name *ecphyaditis* has been proposed, the only exception being that the term perityphlitis may still be used as an adjective to indicate the location of an abscess. Researches of the last few years have made it very evident that almost without exception these inflammations begin in the vermiform appendix, from which point they spread to a varying extent and with varying degrees of intensity. In fact, the appendix is now known to be the primary cause of

nearly all cases of general peritonitis except those which originate from the internal genito-urinary tract or which follow operation. It is then of very frequent occurrence, and causes annually many deaths. The recognition of the importance and frequency of this condition we owe, in the first place, to Reginald Fitz of Boston, whose researches, first published in 1886, have been confirmed by Stimson, McBurney, Bull, Keen, and others, all of whom are Americans. The rapidity with which the views of these writers have gained credence on both continents is testimony alike to their own accuracy and the lack of previous appreciation of the subject.

It is now known that the ratio of appendicular inflammation to primary inflammation of the cæcum is about one hundred to one. So far as the relative frequency of this condition and other lesions of the viscera is concerned, the best statistics are those of Tofft, who found residua of appendicitis in 36 per cent. of all of a large number (300) of post-mortem examinations.

Appendicitis does not necessarily imply adhesions. The appendix may be ready to burst, or be even gangrenous, and still be loose in the peritoneal cavity. At other times, although but slightly compromised, it may be so bound down and buried under old exudates and adhesions as to be really lost.

Keen makes five forms of this disease: 1. Mild without abscess, terminating in resolution. 2. Perforative followed by general peritonitis: *a*. A sub-variety of fulminating form, perforating very early. *b*. A sub-variety, mild for some time and then suddenly perforating. 3. Perforative, but protected by adhesions, so that a local abscess results. 4. A class in which abscesses form slowly—*i. e.* chronic—lasting not only for weeks, but perhaps for months. (The writer has seen this form assume tubercular characteristics.) 5. Recurrent, one attack following another, finally fatal after from two to twenty attacks.

But a few years ago Stimson offered the following classification of inflammations about the cæcum: colitis, pericolitis, typhlitis, and perityphlitis. Than this there was at the time nothing better offered, and in the main the conditions thus outlined are still possible, but we have at last learned that perhaps 99 per cent. of cases coming under one or the other of these headings has its origin in an inflammation of the appendix proper. When thus involved the condition of the appendix may be one of intense catarrhal inflammation of its interior, of distension by pus or by fæcal concretions which are very often mistaken for seeds of various fruits, of perforation without much gangrene, or of total gangrene; and all these may be either with or without adhesions. Under either of these conditions also it may be found surrounded or not surrounded by pus, or giving rise to commencing or well-devel-

oped peritonitis. To indicate how rapidly pus may form under this impetus it need only be said that by the fifth day three pints of pus have formed. It has been held by Bull and others that we have a catarrhal form of perityphlitis causing adhesions, although it is hard to understand how a purely catarrhal form of inflammation can spread to and involve serous or areolar tissue. At all events, catarrh of the cæcum, with ulceration due to the presence of impacted fæces or other irritating material, certainly may and does occur, and thus the opening of the appendix may be involved. Again, the interior or mucous surface of the appendix may absorb fluids, and leave within itself solid materials which are irritating and cause relapses. As mentioned above, many so-called seeds, etc. are actually intestinal concretions or simply inspissated fæcal masses. Matterstock found them in 63 out of 146 cases, with real foreign bodies, seeds, etc. in only 9; and Krafft in respectively 36 and 4 out of 106 cases.

Infection of the peritoneum from such conditions as those just spoken of is to be explained by accepting Eppinger's views concerning necrosis epithelialis mycotica; from pressure of fæcal masses, and subsequent infection therefrom, there follow easy invasion of subepithelial tissue and extension through to the peritoneum. Moreover, by a similar and incomplete process we may have stricture of the appendix near its origin and dilatation of its distal end, with retention, by which recurring inflammation is of course favored.

Weir divides the general condition into the following three forms: adhesive, circumscribed, and diffused, according to their anatomical characteristics:

1. Peritonitis appendicularis adhesiva: ulceration likely to occur deep enough to cause adhesions. 2. Peritonitis appendicularis localis; usually with abscess formation. 3. Peritonitis appendicularis universalis; referring to diffuse, septic, or putrid peritonitis, due to perforation.

Concerning the relative frequency of these forms, Weir collected the findings in 100 autopsies, and found diffuse suppuration 57 times, circumscribed abscess 35, in 13 of which the trouble was also diffuse, and extra-peritoneal abscess 4 times.

By some authors children are regarded as especially predisposed, but the majority agree that it is more common in adults, and for the most part in males. Fitz reports, out of 228 cases, 173 below the age of thirty-one, and 207 below the age of forty-one.

The perforative form of appendicitis, especially that leading to diffuse peritonitis, deserves a little consideration by itself. Of this condition Mikuliez makes two forms—one diffuse, septic, from sudden outpour of fæces through a large perforation: patients die before adhesions can form. This belongs to the putrid form of peritonitis already de-

scribed. The second, a progressive fibrino-purulent form, spreading from the immediate neighborhood of the perforation: fibrino-purulent adhesions form by which the general peritoneal cavity is, at least for a time, protected. It leads to foci of encapsulated pus, and in other words to multilocular abscesses. In one such case he opened six pus-cavities through three incisions made at different times as the abscesses seemed to form.

Perforation may occur very early or not till very late; it has been known to happen within twenty-four hours after the onset of symptoms. It is the explanation for nearly all the fatal cases, since Matterstock found perforation 132 times out of 146 fatal cases, and Fenwick 113 times out of 139 cases. Its occurrence is made known by phenomena to be discussed later.

The following brief summary of the *symptomatology* of the disease will have, as seen farther on, a most important bearing on the question of its therapeutics:

The most common first symptom is abdominal pain, varying in severity, which is sometimes referred to the whole abdomen or to the epigastrium or umbilical region, and which perhaps in half the cases is described as having begun in the right iliac fossa. This pain is sometimes preceded by a prodromal stage of vague abdominal discomfort lasting for several days, and is often misleading, because slight, and is therefore often mistaken for a symptom of colic or enteritis. If the pain have been at first diffuse, it begins after a few hours to be limited, and the exact locality of the greatest pain and tenderness is now of the utmost importance. McBurney has rendered us the greatest service in indicating a point, now generally called by his name, situated on a line drawn from the anterior superior spine to the umbilicus, and two inches, or possibly an inch and a half, from the spine. In this disease firm pressure made over this point with the finger-tip will practically always elicit extreme pain and tenderness, although in the last stages tenderness may have disappeared. This sign is of pathognomonic importance, since no other acute disease presents it. While preparing this article the writer has had additional evidence of its value, since by means of it, accompanied by the history of a brief illness, he was able to make a diagnosis of appendix disease in a case of large fibroid tumor filling up the pelvis and causing stricture of the rectum with enormous distension of the abdomen. By operation speedily performed a large amount of pus was evacuated.

Chill and vomiting may or may not occur. The latter usually ceases if the stomach be given absolute rest. Fever is usually present, but varies greatly in degree. Rigidity of muscles, especially on the right side of the abdomen, is of great importance. Tympanites usually occurs during the course of the disease, and may be prominent even by

the end of the first day. It is usually absent when perforation has occurred. A local tumor may or may not be discoverable during the first or second day; it is usually present by the end of the third day. It consists of the inflamed appendix, or cæcum, or omentum, or all three, along with more or less exudate, and perhaps pus. Circumstances may make it difficult to discover, but one is not to waver in diagnosis providing the other signs be present and the tumor absent.

Increasing distension of the abdomen is a bad sign. It will depend in amount largely on the condition of the bowels and the extent of the intestinal paresis. Patients will usually complain when they cough, and sometimes when the right thigh is completely extended. Aside from the distension and the amount of tenderness, the pulse will usually afford a fair index of the gravity of the disease, which is indeed more reliable than subjective pain. In certain cases examination *per rectum* will reveal a tumor or will give some additional positive or negative evidence. Too much reliance should not be placed upon it.

Exaggeration or increasing intensity of pain, accompanied by symptoms of shock and followed by chill, fever, tympanites, and vomiting, indicate that rupture into the peritoneal cavity has in all probability occurred, although similar bad signs in lesser degree have been known to indicate the formation of pus without perforation. If time has permitted the formation of sufficiently strong adhesions, perforation may occur with less perceptible evidence, nothing more perhaps occurring than chill with extension of tumor.

Of course when an abscess ruptures into the bowel there is a cessation of severe symptoms and a subsidence of the tumor.

Fitz says that 26 per cent., and Stimson that 25 per cent., of all cases of appendicitis prove fatal. According to Fitz, of 176 cases of perforative appendicitis, 60 died during the first five days, 56 during the first four days, 28 during the first three days, and 8 during the second day; all of which goes to show that appendicitis may terminate fatally in less than forty-eight hours. It is moreover certain that in the large majority of cases dying within five days the fatal septic or putrid infection begins before the end of the third day.

Recurrent appendicitis was scarcely spoken of previous to five years ago, but Treves has reported a case in which there were fourteen attacks, and McBurney one in which there were twelve attacks within as many months. Krafft learned that 23 per cent. of the 106 cases which he studied had had similar trouble previously. In general it must be said that of those who have suffered once from this disease none are exempt from liability to future similar trouble except those upon whom the operation for the removal of the appendix has been performed.

Treatment.

There is so little to be said in favor of internal medication in these cases that medicinal treatment can be summed up in very few words. First of all, it is necessary to make plain the fact that the use of opiates for the relief of severe pain is perhaps following the dictates of humanity, but is likely to do great harm on account of masking symptoms which are most important and indicative, and by which alone one must decide when to operate. Anodynes, then, should be given only when absolutely necessary. Cold applications, especially with the coil over the right iliac fossa, may do much to check the course of the disease. Laxatives should be avoided, and the stomach should be given absolute rest, especially if it is irritable. Under such gentle and non-compromising treatment as this the mild cases will improve, or at least cease to advance, while the graver and those which shall soon call for operation will show little or no improvement. It is therefore with wisdom and with justice that Keen has epigramatically stated that the "first duty in the case of appendicitis is to call a surgeon." Nothing has been more clearly shown within a few years than that a large proportion of these cases, if they are to be saved, must be turned over very early for surgical relief. In other words, that their therapensis is essentially surgical, for which reason, before describing the operation, it may be well to stop and consider the

Indications for Early Operation.

These must be carefully watched for from the very outset, since the golden time to operate is before the pathological condition is too far advanced for surgical remedy. Even at the end of the first day operation should be thought of—possibly even performed—if evidences of severe and extending peritonitis develop or if, possibly, signs of perforation should supervene. If in a given case in which appendicitis has been diagnosed or suspected the symptoms are not distinctly improved by the end of the second day, or even after thirty-six hours, it is best to prepare for operation, perhaps even to operate at once. If one wait only for evidence of perforation or even of general infection, disaster will in all probability occur. The acute observer, noting the progress of the case from hour to hour, can usually recognize the signs of impending perforation by a study of the pulse, the temperature, the size of the tumor, the rigidity of abdominal muscles, the development of tympanites, the increase of nausea or vomiting; for which, however, he should not wait. In general, then, it may be said that if tenderness or pressure increase, if the pulse accelerate, the temperature rise, or abdominal distension augment with increase in size or fluctuation of the tumor, operation is to be considered almost inevitable, and should be hastened should there be acute onset of pain. On the other hand, if

nausea disappear in twelve hours, if pulse and temperature subside, and tenderness diminish, the case will probably run a mild course. If these are present at the end of twenty-four hours, the prognosis has thereby improved; but it must be remembered that the majority of the rapidly fatal cases are practically made fatal during the second and third days, and that, so far as perforation is concerned, there are no signs peculiar to this event alone, and that if the case be not improving it is best not to wait. Moreover, there are many undesirable complications incident to too long delay which make the surgeon's work much harder. Distended intestine is restored to place with much greater difficulty, while septic infection, if but begun, is rapidly spread by the manœuvres necessitated during operation.

It will thus be seen, if help is to be afforded in cases in which perforation is imminent or has occurred, that they are among the most urgent to which the surgeon can be called, exceeded in this respect only by impending suffocation or death from hæmorrhage. The wise physician, therefore, is he who calls the surgeon early, and the wise surgeon is he who is always prepared for such an operation.

DIRECTIONS FOR EARLY OPERATION.

These directions are meant to include operation when undertaken under the circumstances just described, at any hour of the night or day and with or without surrounding conveniences. And, first of all, the operation should be made with every aseptic precaution known to the operator, omitting, if possible, everything which may endanger perfect asepsis. If time permit, the skin of the abdominal region should have been covered with a poultice of green soap for the purpose of securing its perfect disinfection.

Since it is difficult—perhaps impossible—to fix on the precise location of the appendix, and inasmuch as there is presumably now no distinct abscess into which we may open at a convenient point, the incision is to be made in the right semilunar line and of sufficient length to permit adequate exploration. As one approaches the peritoneum it is sometimes found that the areolar tissue next to it is œdematous; but this has no known significance. If the peritoneum be found adherent to the tumor or intestine, it must be opened higher up or lower down, and then carefully separated. The small intestines are held upward and toward the opposite side while the operator gently searches for the appendix. If it be not discoverable, the cæcum is to be raised and search prosecuted behind it. Sometimes, however, this is impracticable, and at other times quite impossible. When, therefore, the appendix is not easily found, its location may be best ascertained by following down the band of unstriated muscle-fibres which appears on the anterior aspect of the ascending colon and leads down-

ward toward the origin of the vermiform process. Its location being thus indicated, it must be sought for in the thickened mass of exudate behind the cæcum. If found free, it is tied with or without an aneurism needle, its mesentery being ligated with it by a double ligature or not, according to circumstances. Sponges are then packed under it to receive any discharge, and it is cut away outside of the ligature, which should have been applied as close up to the cæcum as possible. Its stump should now be disinfected with hydrogen peroxide, and then seared with pure carbolic acid or the cautery. If this be done, it will not be necessary to enfold its end and apply sutures. Even if found buried in a mass of exudate, it should be treated so far as possible in the same way; but if the base of the stump of the appendix appear gangrenous, the dead portion should be removed and the stump disinfected, turned inward, and a few Lembert sutures introduced. Care should be exerted to collect upon sponges all pus or discharge or dead tissue, so that nothing may be left in the peritoneal cavity.

If operation be performed late, and after reasonable search one fails to recognize the appendix within a mass of more or less organized exudate or in an abscess-cavity, it will be best to discontinue search and prepare to drain the abscess. Should abscess be found between the layers of the mesocolon extending backward or upward, counter-opening should be made above the iliac crest. On the other hand, if an abscess has burrowed downward alongside of or near the rectum, it will be best to puncture above the sphincter, and by making a counter-opening in this way secure drainage by the introduction of a tube through the rectum.

Under all circumstances it is probably best not to flush the abdominal cavity with an antiseptic solution, but to collect on sponges or suitable substitutes all pus and débris, and with them to dry the exposed surfaces thoroughly. The only exception to this rule should be made in cases of diffuse suppurative peritonitis. A local abscess between the coils of the intestines may also be found, and should be first protected, and then evacuated in the same way.

Unless pus has been met with, the peritoneal cavity is not to be drained after the operation, but is to be completely and carefully closed. Should the abscess-cavity have been opened, it will then be necessary to drain with glass, or preferably with rubber tubing, the end of which is passed down to the stump of the appendix. About the tube should be packed a sufficient quantity of iodoform gauze, which may be allowed to come in contact with the intestines without fear. The incision should now be closed, save its lower opening for the exit of the drain and the end of the gauze which has been packed in. This gauze should be removed in from thirty-six to forty-eight hours, and it is well at this time also to remove the tube, unless discharge be con-

tinuous or insufficient. It is also well to insert secondary sutures, so that after removal of all drainage material the remainder of the abdominal incision may be closed without discomfort to the patient.

Between the above operation—which is made during perhaps the most acute portion of the disease—and deliberate operation between attacks of recurrent appendicitis there is virtually no difference, save that the latter are to be regarded in the light of prophylactic operative treatment, which should be undertaken and carried out when circumstances of time, light, and surroundings make the prognosis even more favorable for the patient.

PERITYPHLITIC ABSCESS.

THIS term may with some propriety be still applied to cases of circumscribed suppuration in the neighborhood of the cæcum, though we know that 99 per cent. of them are due to inflammation beginning in the appendix. Much discussion has arisen as to whether these abscesses are intra- or extra-peritoneal, difference of opinion arising from the supposed importance of such distinction in operating. It is one of little or no practical importance, however, since, whatever such an abscess may have been originally, by the time it assumes the importance of an abscess adhesions have shut it off from the general cavity and have made it practically extra-peritoneal, so that it can be opened usually through the iliac fossa.

Results of Operation.—The results of early removal of the appendix, even when pus has been present, have been for the most part favorable, and numerous lives have been saved which would otherwise have certainly been sacrificed. That it is well to remove the appendix when practicable is shown by the fact that cases are on record of recurrence with great violence in persons who had been operated upon, but the appendix not removed at the time. The conditions are quite analogous, and we may hold that it is as necessary to remove the appendix when we are operating for this purpose as to remove a pus-tube when we are dealing with a condition of pyosalpinx. Should peritonitis of the diffuse and suppurative variety develop after the operation, it would be best, probably, to open the abdomen and wash it out. The possibility of ventral hernia from incomplete or insufficient closure of abdominal incisions must be borne in mind, and care and forethought exercised at the time of the operation, looking to this possibility. Persisting fæcal fistulæ, which may result from operation for abscess, as already remarked, usually close spontaneously in time.

Should they fail to do so, subsequent operation for this purpose may be required.

Treatment.

Between the operative treatment of this condition and that for appendicitis there is no fundamental distinction, save that the operation is not usually quite so hurried, and can generally be postponed at least until daylight, and that one scarcely expects to meet with or remove the appendix, but rather simply to drain a large or small collection of pus through the most accessible and feasible route. An opening is now made over the most prominent part of the swelling, the incision being usually made parallel to Poupart's ligament. Now, ordinarily, as one approaches the abscess-cavity the deeper tissues are more or less infiltrated and altered in appearance and density, and the operator is usually made aware by the sensation conveyed to his finger of the proximity of pus. If during the endeavor to find pus the peritoneum should have been opened by mistake, it should be at once carefully closed and protected, and the search prosecuted in the direction indicated by the information revealed by the mistake. The abscess-cavity having been opened, the finger should be introduced and search be made for fæcal concretions or foreign bodies. Before final arrangements for drainage are made it will be well to wash out and cleanse this cavity, for which purpose hydrogen peroxide is the ideal material. A large drainage-tube surrounded with sufficient gauze packing should be inserted nearly to its depth, and over this a copious absorbing and antiseptic dressing applied. Should it be found that the abscess-cavity connects with the intestine, and that a fæcal fistula is the result, the treatment should, nevertheless, be the same, since experience has shown that most of these fistulæ close spontaneously, with healing and contraction of the old abscess-cavity. When one is quite uncertain in what direction to incise, although confident of the presence of pus, Stimson has recommended to begin the operation as if intending to ligate the external iliac artery, then to lift up the peritoneum from the iliac fossa, and thus open the cavity as it were from behind.

DISEASES OF THE RECTUM AND ANUS.

By CHARLES B. KELSEY, M. D.

Surgical Anatomy.

The rectum measures from six to eight inches in length in the natural position of the parts, but when dissected out it will be found to be a couple of inches longer, because of the straightening of the normal curves. Its upper limit is marked by a distinct constriction, which separates it from the sigmoid flexure, and which can easily be felt by introducing the hand through the anus. This constriction lies opposite the sacro-iliac synchondrosis on the left side, and marks the limit of safe manual examination. Weir in his measurements of the rectum found that a hand of less than 26 cm. in circumference could be introduced from 17 to 19 cm. without inconvenience, but not more. He found the greatest circumference of the rectum to be at 6 or 7 cm. from the anus, where it may reach 25 or 30 cm. At the upper part of the middle third it is not more than 20–25 cm., and thence it rapidly diminishes, being not more than 16–18 cm. at the middle part of the superior third, and still narrower at the constricted junction with the sigmoid flexure. A small hand may, therefore, be passed entirely into the rectal pouch without danger, and the first and second fingers may be passed into the sigmoid flexure for palpation, with the outer hand pressing into the pelvis from above. In this way the two hands may be brought into actual contact except for the separation caused by the abdominal wall and the gut, and many a diagnosis may be arrived at with absolute certainty which were otherwise impossible. To attempt, however, to pass any hand into the sigmoid flexure is attended by far greater danger than would be an abdominal section for exploration and diagnosis.

The rectum has two important curves—one longitudinal, the other lateral. The former follows in a general way the curve of the sacrum from the tip of the coccyx to the promontory. Below the tip of the coccyx it turns sharply backward to end in the anus. The lateral curve is toward the left in the great majority of cases, and this explains why in Kraske's operation of excision the incision is made along the left border of the sacrum. This curve, like the other, does not include the whole rectum, but only the portion between the third sacral vertebra and the left sacro-iliac synchondrosis.

The middle and upper portions of the rectum have important surgical relations. In the former these arise from the proximity of the urinary and genital organs to its anterior surface, the rectum being closely connected with the vagina in the female and with the base of the bladder in the male. The middle portion is covered on its posterior surface in whole or in part by peritoneum, and between it and the sacrum are the sacral plexus of nerves and the branches of the internal iliac artery. On both lateral surfaces it is in contact with loops of small intestine, which explains why in cases of rupture or of extensive prolapse we may have extrusion of many feet of small intestine through the anus. In front, in the male, it is also separated from the base of the bladder by coils of small intestine, while in the female it is in relation with the broad ligament, the left ovary and Fallopian tube, and the uterus and vagina. For this reason it often happens that a bimanual examination by the rectum in a female will give more exact information than a vaginal examination, for the fingers, instead of being stopped by Douglas's pouch, may, through the rectum, be carried behind and beyond it.

It follows from these relations that incisions which involve only the lower portion of the rectum cannot invade the peritoneal cavity, while those which involve the middle and upper portions are very likely to do so. The upper portion of the rectum is entirely surrounded by peritoneum, and generally has a mesentery of considerable length—three or four inches—though hardly anything in anatomy is more subject to variation than the length of the mesentery of the colon, sigmoid flexure, and upper rectum. This meso-rectum in the majority of cases will be found to extend as low down as the third sacral vertebra, from which point it is reflected over the sides and anterior surface of the gut to the uterus and vagina in the female or the bladder in the male, forming the cul-de-sac of Douglas. In thus passing from the sacrum to the base of the bladder or vagina the membrane covers more or less of the sides and anterior surface of the second portion of the rectum.

In the fold of peritoneum forming the meso-rectum are found the blood-vessels, nerves, and lymphatics going to the rectal wall; and the peritoneum, while it admits of the easy motions and changes in position natural in this portion of the digestive tube, does much to hold it in its proper relations, as will be seen by the fact that in cases of amputation of the lower end of the gut it is often impossible to pull down the upper portion till this membrane has been freely divided. In the fold of meso-rectum also we look for involved lymphatics in all cases of cancer of the rectum.

As there may be great variations in the length of the meso-rectum, so there may be in the height at which the folding from rectum to bladder or vagina which forms Douglas's pouch occurs; and this is

important in determining the limit to which incisions in the rectal wall may be carried without opening the peritoneal cavity. The distance of the pouch from the perineum is given by different authorities as from two to seven inches, but perhaps there are no more accurate measurements than those of Cripps, who sought to determine the point by injecting the pouch with plaster and allowing it to set, and then plunging a needle through the skin of the perineum till the point struck the plaster. In this way he found the average distance to be two and a half inches with the bladder and rectum empty, and three and a half inches when both are distended. These figures are, however, of very little practical value, on account of the great variations in different subjects. Naturally, the measurements are much less in new-born children, seldom exceeding one inch, showing the small depth to which an incision for imperforate anus may be carried without opening the peritoneum. In cases in which it is thought desirable the fold of peritoneum may be carried a considerable distance upward into the pelvis by allowing the bladder to become distended.

Passing now from the surgical relations of the rectum as a whole to its individual parts, there are several points worthy of careful note:

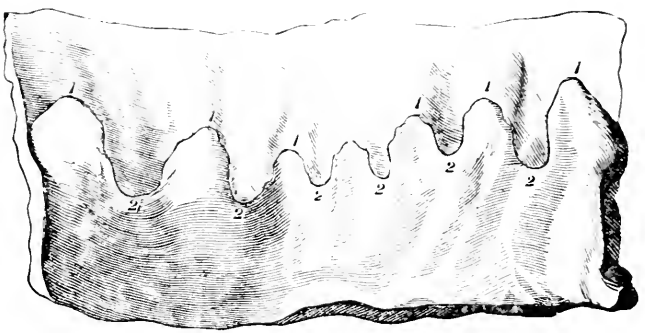
First, it may be well to call attention to the fact that there is no distinct line of demarcation between the rectum and anus. The anus is by Henle considered to be about one inch in length, and therefore to include that terminal portion of the gut which is grasped by the internal sphincter. The expression "fistula in ano" is thus a proper one for the milder forms of the disease, though many will be found to involve the rectum, and not the anus.

Hilton long ago called attention to a white line marking the point of junction of the skin of the perineum with the mucous membrane of the anus, also the point of separation of the external from the internal sphincters, and the place at which many of the terminal filaments of the internal pudic nerve perforate the wall of the gut. The line is by no means easily detected in most subjects.

At the point of union of the mucous membrane with the skin of the anus the former is gathered into vertical folds, which diminish when the bowel is distended, but are not entirely effaced. These have received from the older anatomists the name of *columnæ recti*, or columns of Morgagni, and between their lower ends little arches are sometimes found stretching from one to the other, forming pockets of skin and mucous membrane, as shown in the cut. These are more developed in old people, and doubtless may be the seat of ulceration and abscess due to the retention in them of small particles of fæces. Quite recently there has been considerable discussion concerning them, due to the fact that they have been brought into prominence by certain quacks, who attribute to them many obscure sensations about these

parts, and even provide for their division neat little blunt hooks and curved bistouries in the "rectal cases," which they advertise for the cure of all diseases of the rectum and anus. As a matter of fact, the pouches as distinct pouches seldom exist, though the folds from one column to another can often be seen without any depression into which

Fig. 57.



Columnæ Carnæ Recti and Sinuses of Morgagni.

a probe can be passed. When there is a pouch or cavity, it is as apt to run upward under the mucous membrane as downward, and small pits or depressions may often be found scattered irregularly in the anal mucous membrane. But, like most successful pieces of quackery, there is an element of truth in the midst of all the deceit, and so in this case there is no doubt that ulceration of one of the sinuses of Morgagni may in rare instances cause much pain about the anus, the real cause of which may easily be overlooked.

Passing upward from the anus, the chief point to be noticed regarding the mucous membrane is its great amplitude, which even when the gut is distended by a large speculum prevents it from being drawn smooth for examination. When the finger is passed into the normal bowel the folds of mucous membrane can be distinctly felt projecting into its lumen, and obstructing its passage. Attempts have been made by careful study to give these folds, which are generally transverse, a constant position, and even to give them separate names. In spite of the careful and elaborate work of Otis of Boston on this special point, I have not yet come to admit their anatomical constancy or regularity, and can go no further than Kohlrausch, who describes and figures one fairly constant fold, which he names the *plica transversalis recti*, projecting well into the lumen of the gut from the right side, forming rather more than a semicircle, and involving more of the anterior than the posterior wall. This duplicature of mucous membrane, strengthened sometimes at its base by an agglomeration of the circular involuntary muscular fibres of the gut, is all that there is to the popular and uncer-

tain so-called "third sphincter" of the rectum—the unlocated muscle which has been unnecessarily called into existence to prevent the passage of fæces from the sigmoid flexure into the rectum. As a matter of fact, the circular muscular fibres are gathered into groups at various points of the upper part of the rectum, and the mucous membrane is also folded upon itself transversely; but there is no constancy in the position either of the folds or of the strengthened muscular bands, nor do they seem to have any constant relation to one another. It is necessary to call attention to these folds to explain the difficulty often met in attempting to explore the rectum with the bougie, and the mistaken diagnosis of stricture high up often resulting therefrom.

With regard to the two real sphincter muscles, the external and internal, there are many points of surgical and physiological interest. The external is a voluntary muscle; the internal, located just above and partly within its grasp, is composed of involuntary fibres. The external is a broad but thin layer, elliptical in shape, spread out under the skin for about an inch on each side of the anus, but only reaching about three-fourths of an inch up the canal; while the internal is only 2 lines in thickness, but reaches up the canal half an inch. Both muscles vary much in their development.

These muscles are of the greatest possible surgical importance in all operations about the rectum, and no fibre of them should ever be cut unnecessarily. After forcible stretching they generally regain their tonicity in a few days. Only once have I seen anything approaching permanent incontinence follow this procedure, and in that case the stretching was unduly severe; and as time passed on they gradually recovered in a great measure their tone under proper treatment. In most cases it is safe to divide them both by a single incision, preferably in the median line, and they will regain their function after the incision heals, as is so often the case in fistula. A double division of both muscles should never be done unless in grave disease, when subsequent incontinence to a greater or lesser degree may be predicted, especially in women. The muscles should never be divided by a slanting incision when one directly across the fibres can be made to answer the purpose.

Although incontinence of fæces from incision and faulty union of the sphincters is a most serious condition, and one which would often be made public in suits for malpractice were it not for the delicacy of the sufferers, my own observation has tended greatly to surprise me by proving how very comfortable many people are who have absolutely no sphincteric control. To understand this, the function of the sphincters must be studied, and the first notion to be abandoned is the popular one that but for their action there would be a constant escape of

fæcal matter. This, except in cases of diarrhœa, is by no means the case. The function of defecation is a complicated one, made up of several physiological factors, and the sphincteric control is but one element in the whole—an element which frequently is absent without the knowledge of the individual. In the normal act of defecation the sphincter plays a very minor part. The solid fæcal mass is accumulated in the sigmoid flexure till the daily time for defecation comes. It does not press upon the sphincters, nor is it ready to escape at any moment when the voluntary contraction of the guardian muscle is relaxed. On the contrary, the first step in the composite act of defecation is an entirely involuntary increase in the peristaltic action of the sigmoid flexure and upper rectum, taking place at a certain hour every day, due perhaps to the pressure of an increased amount of fæces, but in great measure to what may, for lack of a better term, be called habit, and often seemingly dependent upon a certain routine—the morning meal, the hot drink, or the morning cigar. Following the involuntary increase in peristalsis, which causes the desire for defecation, comes the voluntary act composed of two factors—the first an active contraction of the abdominal muscles, and the second a voluntary relaxation of the sphincter, which is habitually in a state of tonic contraction. Should the sphincter be incapable of this tonic contraction, there would be no noticeable change in the sequence of events as far as the individual's knowledge extended, and the act would take place as it normally does. I have seen many men utterly without the power of contracting the sphincter muscle who went through the act of defecation every day, and told me they had perfect control when in reality they had none. The most marked case I ever have seen was one in which by extensive cicatrization after operation the lower three inches of the gut was converted into an open cicatricial canal, readily admitting at all times two fingers, over which the patient had absolutely no muscular control; and yet he did not know that he was incapable of performing any part of the act of defecation, for all of it, except the voluntary relaxation of the sphincter, was performed, as it had always been, once a day immediately after breakfast.

The function of the sphincter which is of greatest importance is the opposite of the one we have been considering. It is the voluntary contraction instead of the voluntary relaxation of the muscle, the loss of which causes the suffering when the muscle is wounded; and should an individual like the one just referred to attempt to postpone or delay the act of defecation he would instantly realize his incompetence. In cases of diarrhœa the act must often be delayed; the power to do this by voluntary sphincteric contraction is lost and hence the suffering. To the man or woman who never has diarrhœa the sphincter is of little

importance; to one suffering from intestinal catarrh life may become an almost intolerable burden.

It is well to bear this action of the muscle in mind in reading the reports of extirpation of the rectum and other grave operations, in which the statement is made, as it often is, that the patient has good sphincteric control except when the passages are loose. The patient who has "good sphincteric control except in case of diarrhœa" has very little if any control.

The external sphincter is supplied by the fourth anterior sacral nerve, as are also the levator ani, the coccygeus, the rectum, and the bladder. In doing high amputations of the rectum it is well, therefore, to avoid as far as possible the fourth anterior sacral foramen, through which this branch of the sacral plexus emerges. Bardenheuer's transverse section of the sacrum is made, however, at the level of the third sacral vertebra, and the fourth nerve sacrificed when necessary to remove extensive cancerous deposit. Paralysis of the bladder has been known to follow this high incision.

Examination and Diagnosis.

The first step in the diagnosis of any disease of the rectum is to obtain a clear history of the case. The patient may be able to give this intelligently, or it may have to be arrived at by careful questioning, but in one way or the other the surgeon must find an answer to the following questions: How long has the trouble existed? Is there any pain, and if so what is its character? Is there any protrusion of the bowel at stool? Are the bowels regular, or is there an escape of blood, pus, or mucus? Has there been any emaciation? When this information is obtained, more than half of the work is done, and sometimes the examination to follow may be almost a matter of form.

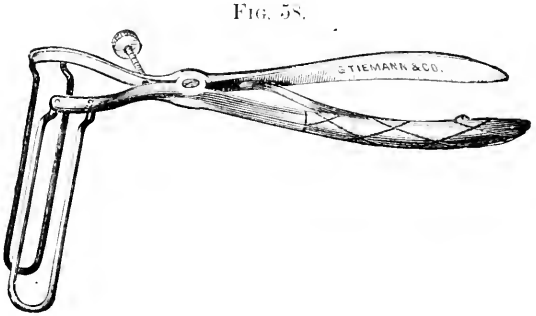
And yet the examination is never to be omitted, for it is simply wonderful how an intelligent patient may lead his physician astray by a verbal description of his symptoms. Patients will tell you they only have one passage a day, when they have been going to the closet ten or a dozen times every day for months, the passages of blood and slime not being counted, but only the solid fæcal matter. In fact, I have been deceived so often by the answers to this seemingly plain question that I have come to change the phraseology, and the question now is generally not how many passages do you have a day? but, how many times do you go to the closet in twenty-four hours?

The best position for examination in either sex is on the left side, with the knees flexed on the abdomen and the buttocks raised by a tilted examining-table or chair. In my own work I use a plain four-legged table which can be elevated at the foot. The only instrument

necessary for an ordinary examination is the index finger. By it, after the necessary skill has been acquired, the examiner can detect piles, fissure, fistula, abscess, and cancer; can diagnosticate between the different varieties of ulceration; and can tell the nature of a stricture far better than by sight.

The speculum is important, but is seldom used for diagnosis. Its greatest use is as an aid to treatment—to facilitate the making of applications to diseased surfaces. In an obscure case, where pain is complained of and digital examination is negative, the speculum should be used while the patient is under ether, and a careful search made over the lower three or four inches of the bowels. The best instrument for this purpose is the one shown in the cut. It is the rectal speculum of the late Marion Sims, only the blades are made fully an inch longer than in his. With this instrument and anæsthesia the

FIG. 58.

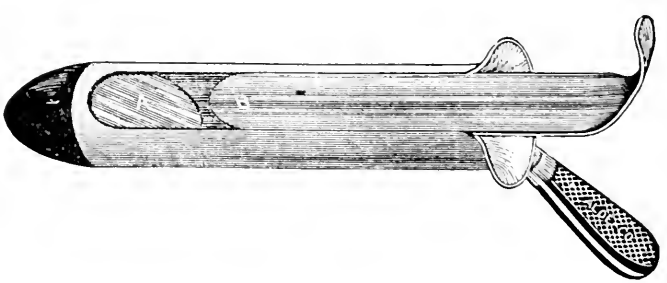


Sims's Speculum.

rectum can be carefully examined for the lower four inches, but to attempt to do so without ether will only be to inflict useless pain.

Another useful speculum is figured below. In it advantage is taken of the reflected image on the mirror (A), and an ulcerated

FIG. 59.



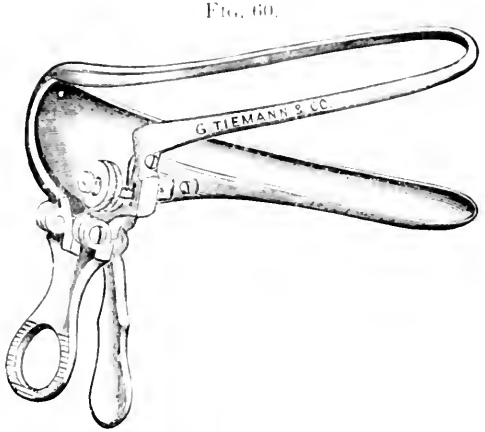
Aloe Speculum.

surface can be reached for treatment through the large fenestrum. This instrument is made in three sizes.

Still another which answers a very good purpose is one which I

believe is sold under my name, but for which I claim no originality. It is simply the old duck-bill vaginal speculum, with one blade fenestrated to the greatest limit possible. It is easy to introduce, gives as little pain as any, and does not put the parts so much upon the stretch as to distort the natural appearance, which I find a matter of considerable importance in some cases. A superficial loss of tissue, for example, in the mucous membrane looks very differently when seen through a speculum which stretches the surface to the point of fissuring than through one which allows it to fall evenly and naturally between its blades.

Fig. 60.



Author's Speculum.

One other variety which must not be omitted is the well-known Sims's vaginal speculum, with the groove for the sphincter as suggested by Van Buren.

With these instruments the surgeon's armament is as complete as it would be with more; and the older he grows in rectal surgery the less use will he have for any of them.

There is one other instrument useful in diagnosis when skilfully used, but liable in unskilled hands to lead to error, and even to irreparable harm—the bougie. Of this but one variety should be sold for exploration, or indeed, in the vast majority of cases, for any other purpose, and that is the flexible, red-rubber, perforated one known as Wales's. This comes in all sizes up to No. 12, which measures one inch and three-sixteenths in diameter. For ordinary exploration No. 7 or 8 will be found best adapted. There is no way to describe how to explore the upper rectum with this instrument. Even in the best of hands it may give valuable information or may lead to error. It should be used only after the gut has been thoroughly emptied by an enema, and should then be well oiled and passed gently upward till it stops, as it almost always will, at the promontory of the sacrum or in the sulcus formed by a fold of mucous membrane. It should be passed with the patient on the left side, to avoid the large fold of mucous membrane generally to be found on the right wall. When it has been stopped at this point, a Davidson's syringe should be attached to it and about four ounces of warm water thrown through it into the bowel. This distends the gut,

draws the folds out of the way, helps the instrument also past the promontory, and if no pathological obstruction is present allows it to be passed its full length—about twelve inches. But when this has been done, if there are symptoms of ulceration of the rectum or sigmoid flexure, the examiner may well be guarded in diagnosis and prognosis. The bougie has passed, it is true, but there may be fatal disease none the less. Positive evidence is here much more valuable than negative. If after proper trials I failed in my own practice to pass a medium-sized bougie on successive attempts, I should be willing to diagnosticate a stricture in the upper rectum; but it would not be safe to say there was no stricture and no extensive disease because the bougie had passed did the symptoms point to such disease.

Too much caution cannot be exercised in the employment of this means of diagnosis. With a heavy hand even a flexible bougie is a dangerous instrument to use in an ulcerated and thinned rectum.

In cases of doubtful disease above the limit of touch and vision there is still one method of examination better than all others. This consists in bimanual examination under ether, with one hand wholly or partly introduced in the rectum. With a small hand the whole rectum can thus be explored, and with deep pressure upon the abdomen the two hands can be brought near enough together to detect any decided thickening of the wall of the gut. To accomplish this it is not necessary, as a rule, to introduce through the anus more than the extended fingers and palm of the hand, and this procedure is attended by no great danger. It is different with the attempt to pass the whole hand and forearm into the sigmoid flexure, as has been done, for in this the danger of rupturing the bowel is imminent.

It will thus be seen that the whole question of diagnosis resolves itself into drawing correct inferences from the patient's history, and into recognizing what can be detected by the sense of touch—touch first with the index finger, next with the bougie, and finally with bimanual examination; and the greatest of all aids is anæsthesia. The rest must be learned by practice and experience. There is something characteristic in the feel of each disease which can never be described, but must be experienced. Rarely will the skilful examiner mistake cancerous deposit for dysenteric stricture, or tubercular for simple ulceration. About the most difficult of all affections for the beginner to recognize by the finger alone is hæmorrhoids.

For any delicacy of examination in an obscure case it is evident that the rectum must be absolutely empty and clean. For this reason a closet should always connect with the examination-room, not that an enema must be given to every case by any means, but in doubtful cases or those in which it is intended to use the bougie it is indispensable. Small particles of solid fæces held in the folds of the mucous

membrane may easily be mistaken for polypoid growths or for the roughened surface of an ulcer, and a patient can extrude his own piles, prolapsus, or polypus much more easily when sitting on the closet than when lying on the examiner's table.

Congenital Malformations.

Although no practitioner sees many cases of congenital malformation, the condition is not so uncommon but that any one may be called upon to treat it at any time, and very possibly when far removed from the opportunities for consultation. As far as my own experience goes, I am ready to believe that a majority of these cases occur in the lower walks of life, and, either from lack of diagnosis or from an ignorant dread of surgery on the part of the parents, are allowed to die unrelieved. Twice during the past year's hospital practice parents have resisted all my persuasion to allow me even to incise an occluding membrane when the little sufferers were in the midst of severe intestinal obstruction.

To understand properly the varieties of this condition it must be remembered that the rectum and anus are developed from different layers of the blastodermic membrane—the former from the internal and middle layers, the latter from the external. The primitive intestine terminates at first in a cul-de-sac common to it and the urachus. About the eighth week a partition is formed dividing this cavity into the rectum and the uro-genital canal, the partition being the perineum. At the same time a depression is being formed in the skin at the site of the anus, which, gradually extending upward, unites with the blind rectal pouch about the end of the fourth week. All of the malformations found at birth are due either to a failure to form a suitable depression in the external blastodermic membrane for the anus, to a failure of the rectal cul-de-sac to descend low enough to meet the depression thus formed, or to a failure to form a perfect perineum and septum between the rectum and the uro-genital canal.

The varieties of malformations may be arranged into various groups. The simplest of all is a mere narrowing of the rectum or anus at some point without complete occlusion—a congenital stricture of greater or less calibre. This narrowing may be very slight, or may reach a degree which hardly admits the passage of meconium. In the former class of cases the condition may never cause any symptoms, and is very likely to go undetected till the patient reaches adult life. It is a curious fact that many of these cases go to adult age without complaining of anything but chronic constipation, and yet after a certain time of life begin to show all the symptoms of stricture with ulceration. This clinical fact has been explained on the ground that in infancy and youth the tissues have no

tendency to contraction or induration, but, on the contrary, are supple and elastic, and the function of defecation is carried on without great difficulty in spite of the obstacle; while at a later period the trouble becomes more marked, there is increasing obstruction, the embryonic tissue begins to degenerate, and ulceration is added to the obstruction.

In treatment this embryonic tissue will be found very rebellious and unyielding to anything but the knife. Dilatation may accomplish good, but complete division and subsequent dilatation will do much more.

This form of disease must not be confounded with the one now to be described, in which either rectum or anus is occluded by a mere membranous diaphragm drawn across it like the hymen, and being completely impervious or having perhaps several openings. The membrane may be of greater or less firmness, and may be composed either of skin or of mucous membrane. It may be thin enough to bulge with meconium when the child strains, or even to rupture spontaneously. This is the simplest of all the varieties to treat, yielding readily, as an imperforate hymen would do, to a crucial incision; but, unfortunately, it is also one of the rarest forms of the disease.

We come now, naturally, to the more serious forms of these affections—conditions which may confront the practitioner at any moment, and which require a considerable degree of surgical knowledge for their proper treatment.

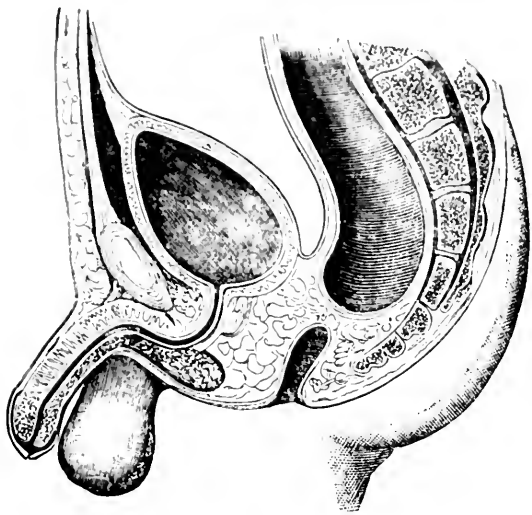
The third class of malformations includes all those cases in which there is an entire absence of the natural anus and the rectum ends as a cul-de-sac at a greater or less distance from the skin. Some of these cases are marked by a slight dimple at the point where the anus should be; in others the perineal raphé extends directly over the spot. The presence of a dimple is not to be considered as an indication that the cul-de-sac is any nearer the surface than it would be were the raphé well marked. The external sphincter is also sometimes well developed, and at other times entirely wanting. A distinct fibrous cord may be present leading from the cul-de-sac to the skin, or the rectal pouch may hang free in the pelvis or be attached to some adjacent part.

The fourth variety includes the cases in which the rectum ends as above, but where the anus is normal. In these cases the septum is composed of fibrous tissue lined both above and below by mucous membrane, and it is not, as in the second variety, merely a membranous partition, though it may be perforated and allow of a slight dribbling of meconium.

In another variety the anus is absent and the rectum ends by a fistulous opening somewhere in the perineum or sacral region, and in still another variety the anus is also absent and the rectum terminates in the urinary or genital tract. Forty per cent. of all cases will be

found to come under this latter class, and the variety in which the rectum ends in the vagina is the most common. In females the opening

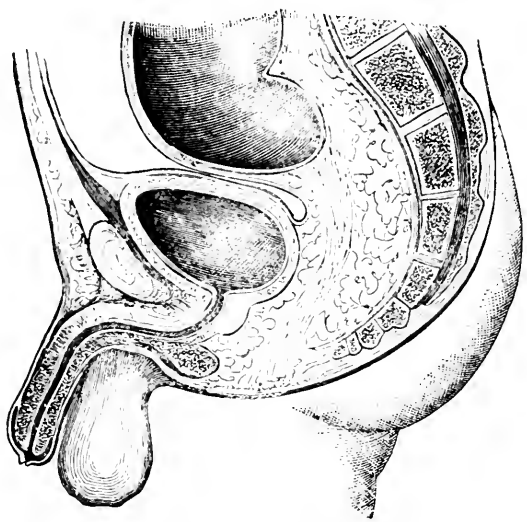
FIG. 61.



Rectum ending in a Blind Pouch, anus normal.

is very rarely into the bladder, while in males it is more often into the bladder than into the urethra. In males, when the communication is ure-

FIG. 62.

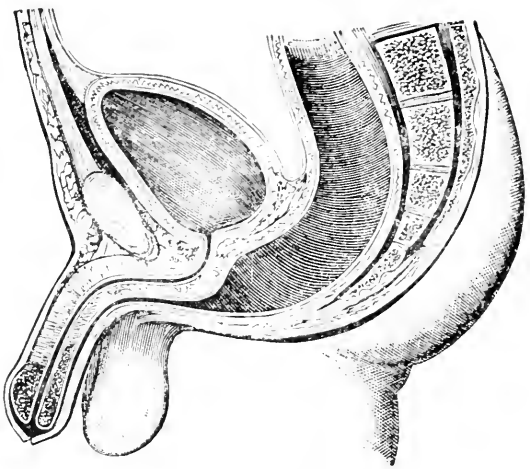


Same as last, with Absence of Anus.

thral, the meconium will at times dribble away from the meatus independently of the act of urination, and, though the first flow of urine may be mixed with meconium, the remainder will be clear. When the

communication is with the bladder, the whole of the urine will be thick and greenish, and the condition is much more serious. Children with

FIG. 63.

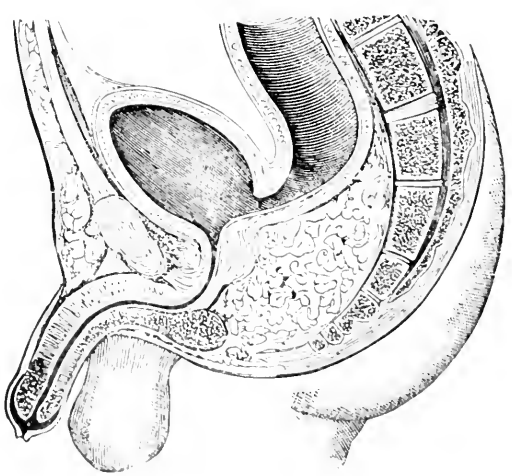


Rectum ending in Fistulous Track.

a vesical opening are, as a rule, quickly exhausted by the resulting cystitis, but with an urethral opening the patient may reach adult age.

In the diagnosis of the third and fourth varieties it is naturally of the utmost importance to determine the position of the rectal pouch and

FIG. 64.



Rectum ending in Bladder.

its distance from the surface of the perineum. In some cases a bulging and fluctuation on coughing or crying will indicate that the cul-de-sac is only a short distance from the skin or from the bottom of the anal

depression; but these cases are rare, and any attempt to cause bulging by the administration of a laxative is unjustifiable.

In a general way it may be said that if the pelvis is normal in its measurements and the external genitals show no malformation or lack of development, there is a probability that the defect in the rectum is not of the most serious kind, and the pouch is pretty near the surface. Nearness of the tuberosities, on the other hand, is a sign that the cul-de-sac is high up; and vaginal exploration may be of great assistance, for if the vagina or bladder take the place in the hollow of the sacrum which should be filled by the rectum, the indication is plain.

In the treatment of these cases we must be guided by the accumulated experience of many men rather than by individual opinion. Collected and analyzed, the cases give results from which clear general rules of practice may be deduced.

In the first variety the treatment has been indicated. In the class of thin membranous septa life may be prolonged and the child may be cured by nicking and subsequent dilatation. Difficulty may be experienced in deciding when this plan is applicable to the fourth class; but when the septum is firm and unyielding, even though meconium may dribble through it, treatment by nicking and dilatation will only give temporary relief, and the calibre thus gained cannot be maintained by the use of bougies.

In the fourth variety an exploratory operation should always be undertaken to try and reach the cul-de-sac, and failure to accomplish this should be followed immediately by left inguinal colotomy. If the rectal cul-de-sac be reached, it must be drawn down and attached to the skin of the anus, so that the incision through the perineum may be furnished with a mucous lining, otherwise it will immediately contract into a mere fæcal fistula, which will eventually cause the death of the little patient, and which can never be kept open by bougies.

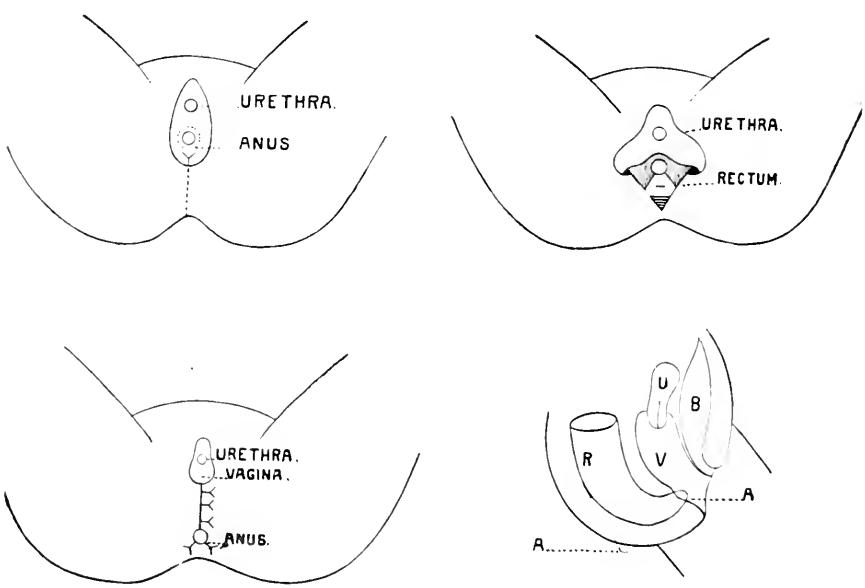
In this operation the cutaneous incision should reach from the scrotum to the tip of the coccyx, and should be carried upward and backward in the direction of the hollow of the sacrum. With a sound in the male urethra or female vagina, and frequent use of the finger in the incision and deep pressure on the abdomen to detect fluctuation, the incision may be deepened stroke by stroke until it has extended an inch or an inch and a half, when, if the pouch be not reached, it should be abandoned. The use of a trocar through the incision is evidently unsurgical. Even when successful in finding the pouch, the puncture does no good, and the bladder, uterus, or peritoneum are much more liable to be punctured than the cul-de-sac. Again, the cul-de-sac often hangs loose in the pelvis and is covered by peritoneum, so that its puncture in this way is merely the cause of fæcal extravasation into the

peritoneal cavity and death. In Cripps's table there are 14 deaths in 17 punctures with the trocar.

In cases where the cul-de-sac has been reached by the perineal incision it may not be possible to draw the end of the gut down and attach it to the skin at the site of the normal anus. In such the coccyx should be excised to allow room, and the anus established at that point.

In the cases in which the gut terminates by a fistulous opening in the perineum or in the urethra, an attempt should be made by free incision to find the cul-de-sac and bring it to the surface, either in the perineal or sacral region, as in the last class of cases, and failure to do this should be followed by colotomy. In the variety of recto-vesical fistula colotomy should be done without previous perineal search. In the cases of urethral fistula the surgeon may delay operation for a time if there be no signs of intestinal obstruction or if the malformation be not exhausting the little patient by irritation. Some of these cases

FIG. 65.



Rizzoli's Operation.

seem to suffer little from the condition, and every week that can be gained renders the pelvis larger and the operation proportionally easier; but the watch kept on the patient's condition must be very close.

In the cases of recto-vaginal fistula the problem is easier, because the opening is generally large enough to prevent intestinal obstruction

or can be made so by gentle digital dilatation, and operation can be postponed till the pelvis has had time to develop. The operation of Rizzoli should then be performed.

With the patient in the lithotomy position a sharply-curved vesical sound is passed into the rectum through the vaginal orifice. An incision is then made in the median line, reaching from the margin of the anal orifice in the vagina to the tip of the coccyx, and carried deeply enough to reach the surface of the rectum, but not deeply enough to cut into it. The dissection of the rectum must be continued cautiously till it is completely freed from its attachments, and the incision must be carried around the vaginal anus with its sphincteric fibres till it can be transplanted without much traction into the posterior angle of the cutaneous incision, as near as possible to the coccyx. The separation of the rectum on its anterior surface should be complete. The margin of the anus is next to be stitched to the cutaneous surface; the sides of the vagina are then approximated; and lastly, the perineum is repaired.

Proctitis and Periproctitis.

Simple proctitis may be either traumatic or catarrhal.

Traumatic proctitis may be due to any sort of violence, and perhaps that arising from the too frequent or rough use of the syringe is the most common. Foreign bodies are sometimes introduced into the rectum in gratification of erotic desires, and set up severe inflammation. There is a school of quackery in our country which rests mainly on the use of a hard-rubber syringe for the patient's self-treatment. The nozzle is long, and bent at a right angle to the cylinder, and the brain of the quack is exercised in telling the patient just where on the posterior wall of the rectum his "ulcer" is situated, and in putting an umbrella ring round the long nozzle of the syringe, so that it may reach just to the proper point and stop. The patient then throws a forcible stream of medicated fluid or hot water against exactly the same point in the rectum daily till the ulcer which he is supposed to be curing is no longer a delusion, but an actuality.

The worst case of traumatic proctitis I have ever seen is now under my care, and has been for some months. It arose from the injudicious use of topical applications to a supposed stricture of the rectum through a speculum. The applications were made four times a day, and the patient tells me they were composed of some acid. At all events, the proctitis ended in an ulcer three inches long by one and a half wide, which resisted all treatment for many months, but finally yielded to prolonged rest and diet.

Catarrhal proctitis may be acute or chronic. The acute form is more often due to the retention of hard scybalous masses than anything else. Another frequent cause is too active purgation often

repeated. Servants who live upon liver pills or some other patented cathartic suffer from this, as do also children with pin-worms. Chronic proctitis, generally circumscribed, is not an uncommon result of the pressure of a heavy or misplaced uterus upon the gut, and is almost always associated with benign polypus. It would seem as though the new growth acted as a foreign body and produced inflammation in the surrounding mucous membrane merely by mechanical irritation. These cases are often very severe, and are always incurable till the polypus has been removed.

Esmarch and Bushe both give the gouty diathesis as a cause of chronic proctitis, and treat it by the usual remedies for the condition. In almost all cases of prolapsus, hæmorrhoids, or benign growths of the rectum a certain amount of chronic proctitis will be found associated.

Besides these causes of acute or chronic proctitis, there are certain specific poisons which will produce the disease. These are gonorrhœa, dysentery, and diphtheria. Gonorrhœa and dysentery will be more particularly referred to under Ulceration and Stricture. Diphtheritic proctitis is a local manifestation of the general poisoning, exactly analogous to the inflammation of the air-passages and attended by the production of the same exudate—in males in the rectum, in females generally also in the vagina.

In the acute variety of catarrhal proctitis the inflammation does not extend deeper than the mucous membrane, which is congested and hyperæmic. In the chronic the inflammation involves the submucous and muscular layers. The acute variety generally ends in resolution in a week or a fortnight when the cause can be removed, but it may go on to actual destruction of tissue and death of the parts. The chronic results in infiltration and thickening of the wall of the gut, which may end in superficial or deep ulceration.

The symptoms in the acute form are heat and weight in the part, with pain involving the uterus, bladder, and sacrum and radiating in all directions. The anus becomes red, excoriated, and painful, and sometimes the mucous membrane may become slightly everted from swelling. The evacuations are frequent and painful, and sometimes streaked with blood, every particle of fæces acting as a direct irritant to the involved mucous membrane. In the more severe forms there is a train of constitutional symptoms added to the local ones.

In the chronic form of the disease the symptoms are all less marked, but equally significant. The diarrhœa and tenesmus may alternate with constipation, and the discharge ceases to contain blood and is composed of mucus voided only with the fæces. The pain in great measure disappears, and leaves only a sense of weight and uneasiness to mark the condition.

The treatment of proctitis consists first of all in removing the cause. If hæmorrhoids are at the bottom of the trouble, they must be removed; so also with polypus. If the uterus be at fault the case should be handed over to the gynecologist. After this has been done the treatment is both local and constitutional. Absolute rest in bed, a diet of milk, meat, and eggs, daily evacuation of the bowels, and sedative enemata of starch, bismuth, and opium, will generally suffice in a few days for an acute case. In the chronic form local astringents may be necessary, and, unless the disease be well circumscribed, these should be made by enemata and not through the speculum, which is in itself an irritating mode of treatment. Sulphate of zinc, tannin, and weak solutions of nitrate of silver may be tried in turn. For the treatment of the cases in which ulceration has resulted the reader is referred to the section on Ulceration.

Periproctitis may be circumscribed or diffused, and may be the result of direct traumatism, but is generally septic. In the diffused form it is the most frequent cause of death after operations upon the rectum. It is analogous to septic peritonitis following childbirth, and in its clinical history strongly resembles pyæmia. The report of a single case will convey a clear idea of the disease. In about forty-eight hours or three days after an operation the patient has a chill and a sharp rise of temperature, sometimes to 105° F. Almost immediately a careful examination will reveal somewhere in the pelvis or buttocks a brawny swelling, which is tender on pressure and perhaps red on the surface, but contains no pus. If the inflammation be very deep, this may first appear several days later above Poupart's ligament. Great sloughing is sure to result, and the patient is most likely to die of chronic pyæmia and exhaustion. In one of my own cases, in spite of very free incisions into the buttock and perineum, the sloughs steadily continued for weeks, causing frequent hæmorrhages, opening into the rectum in two places, and finally into the bladder, and causing the death of the patient by exhaustion. In another no incision was possible; the inflammation first showing itself by the infiltration of the right side of the abdominal wall above Poupart's ligament, and steadily advancing in the cellular plains till it reached the axilla. The only treatment for the condition is free incision as soon as the inflammation can be detected.

In the circumscribed variety the prognosis is less grave, though large abscesses result and cause bad fistulæ. Here also deep incision and free drainage are the only proper treatment.

Abscess.

Superficial abscesses around the anus may arise from a multitude of causes. The simplest form is that which originates in the delicate skin

of the margin of the anus, either from slight traumatism or irritation, or from inflammation of one of the glands with which the part is studded, or the suppuration of an inflamed cutaneous tag of skin or external hæmorrhoid.

This form of abscess is always distinctly circumscribed, causes intense pain, and ends in rupture on either the cutaneous or the mucous surface, almost invariably producing in the end a small superficial fistula. I have seen several examples of this trouble from the use of carbolic-acid injections into hæmorrhoids, the injection causing suppuration beneath the pile, and the pus finding its way to the surface just at the verge of the anus.

Inflammation at this point seldom ends in resolution, and as soon as there is any evidence of pus the knife should be used. Much discussion has been indulged in as to the proper incision in these marginal abscesses, whether a mere free evacuation of the pus is all that is necessary, or whether the usual operation for fistula should be performed, notwithstanding the existence of only an external opening. I have tried both ways many times, but seldom have succeeded by cutaneous incision into the abscess-cavity alone in preventing a subsequent opening on the adjacent mucous surface; and my present practice is, after making a cutaneous incision, to pass a director to the point where the wall of the abscess on the rectal side is the thinnest, perforate the gut at this point, and cut as for fistula.

An abscess within the rectum may at any time result from the suppuration of an internal hæmorrhoid, and may end either in a bad form of ulceration or in a blind fistula of the internal variety. This is another not infrequent result of the method of curing hæmorrhoids by injections.

One other form of superficial abscess arises from suppuration of the subcutaneous connective tissue. This may be due to any traumatism, to exposure to cold, as sitting on a damp seat, or, in proper subjects, to tubercular ulceration at the margin of the anus. In the latter class of cases a slight perforation of the mucous membrane from the breaking down of the tubercular deposit is the first step, and the acute inflammation of the adjacent cellular tissue the result. These cases may be attended by very slight symptoms while quite large collections of pus are forming.

There is but little hope of resolution in these subcutaneous abscesses also, and an early free incision should be made as soon as pus has formed. If the wall of the abscess has approached so near the gut that only the wall of the gut shuts off the abscess-cavity from the rectum, perforation is almost certain to occur, as in marginal abscesses, in spite of a cutaneous incision; and the better practice is to break through this barrier with a director and divide the sphincters. In tubercular patients

more than this must be done. In such cases the abscess always has an internal orifice, and means must be employed thoroughly to destroy all the tubercular deposit. This is best done with the Paquelin cautery, but the sharp curette may be substituted.

A more serious form of abscess around the rectum is that which originates in the ischio-rectal fossa or in the space bounded by the levator ani above and the skin below. Here also traumatism plays an important part in the causation, but another kind of traumatism is to be looked for. The presence of foreign bodies, either swallowed, such as fish-bones, or introduced *per anum*; the violent use of the syringe and the perforation of the rectal wall by the end of the pipe; and the inflammation so often seen in connection with old strictures of the rectum,—are all active elements in the causation of this variety of disease.

Abscess in this locality shows itself by all the usual signs of acute inflammation. There may be considerable constitutional disturbance, chill, and rise of temperature; and there will be local pain, tenderness, and a hard swelling. The pus, if left to itself, finds its way eventually to both the cutaneous and mucous surfaces, and a deep fistula is the result. The deep urethra may be pressed upon, with resulting retention of urine. This is a thing which should always be guarded against in any of the more serious abscesses of this part. Several times I have seen it overlooked where the condition was perfectly evident, the patient's complaints being all referred to the abscess; and in one very sad case I saw the life of a strong young man sacrificed.

Doubtless, an abscess of the ischio-rectal fossa may undergo resolution with any kind of treatment or with none at all, but it seldom does. The proper treatment is an early and free use of the knife, the design being to prevent the formation of the fistula which is almost certain to be the result when nature is left to its own course. As soon as the hard, brawny swelling appears, without waiting for pus it should be freely incised. Ether should be given, and a fine, straight bistoury should be entered at the centre of the swelling and pushed straight forward parallel with the gut, till pus issues by the side of the blade if pus be already formed. When it is certain that the centre of the abscess has been reached, a generous incision should be made as the knife is withdrawn. Into this incision the finger should be passed, and all partitions and sloughing tissue broken down, the cavity being scraped out as far as possible, and irrigated with bichloride solution, 1 : 2000. Again, the point will arise as to the propriety of cutting into the gut, as in the usual operation for fistula, and this must depend upon the condition of the parts. If the abscess be only three or four days old, if after thoroughly clearing out the cavity a considerable wall of healthy tissue be found between it and the mucous membrane, the abscess may

be treated as one elsewhere, having no connection with the rectum, would be. In other words, the cavity may be filled with iodoform gauze, and it will heal from the bottom and no fistula be formed. This is the object of the early incision. But if, when the incision is made, nothing but the wall of the gut separates the rectum from the abscess-cavity, this work of perforation may as well be completed by the surgeon and the sphincters divided, for in most cases no amount of care will prevent the formation of an internal opening.

There is still another variety of abscess much rarer than any of those already mentioned, and much more serious. The superior pelvi-rectal space is described by the French anatomists as contained between the superior aponeurosis of the levator ani below, the peritoneum above, the rectum, and the walls of the pelvis. It has a variable extent in different subjects, and especially varies according as the levator is relaxed or contracted. Its greatest extent is reached when the muscle is in repose. At its anterior part the pelvi-rectal space is much less extensive than at the sides or behind, because the peritoneum is much lowered in front of the rectum to form the recto-vesical cul-de-sac, and gradually rises behind to meet the sacrum; and the plane of the levator is in a reverse direction to that of the peritoneum, and inclines from the prostate to the coccyx. The two planes are separated in front only by a few millimetres, while behind they are several centimetres apart. An abundant cellular tissue with large and lax meshes fills this entire space, and communicates with that of the iliac fossæ and the deeper regions of the abdomen through the medium of the subperitoneal cellular tissue of the pelvis, and in women it is continuous with the cellular tissue of the broad ligament. Behind, it is continuous with that of the meso-rectum and the concavity of the sacrum, and it communicates with that of the gluteal region through the sciatic notch.

In this space between the peritoneum and the levator abscesses occasionally form, and from the anatomical description it is easy to understand why they may assume such vast proportions, burrowing laterally into the subperitoneal tissue of the iliac fossæ, discharging into the bladder, vagina, or rectum, mounting upward and pointing in the groin or loin, passing downward through the sciatic notches into the thigh, and causing by their pressure retention of urine or acute intestinal obstruction.

These abscesses are due to the causes already described, and to some others. They sometimes follow childbirth, and may be due either to direct injury by the head of the fœtus or to septic poisoning. They are also secondary to diseases of the urinary organs, as gonorrhœa, acute inflammation of the prostate, or rupture of the urethra and extravasation of urine. A hairpin introduced *per anum* has been known to perforate the sigmoid flexure and cause fæcal abscess open-

ing in the lumbar region, over the great trochanter, and finally in Scarpa's triangle.

The symptoms are often surprisingly obscure for the gravity of the disease. There is more or less vague pain in the pelvis and lumbar region, which is seldom intense, but is generally increased by defecation. Fever may be entirely absent, is seldom continuous, and chills are only occasionally met with. On the other hand, the patient may rapidly sink into a typhoid condition, with high temperature and diarrhœa. Vesical symptoms are apt to be more marked than rectal ones, and there is apt to be retention of urine.

To show how insidiously the disease may advance, I may say that not long ago the house physician of a hospital asked me to look at a man, supposed to be rather a medical than surgical case, in whom he thought he detected an induration in the iliac fossa on the right side. The patient had scarcely any history except that of some wandering pain in the pelvis, which on deep pressure he located rather toward the right side. His temperature had been taken for some days, and occasionally showed a rise of a degree, but was generally normal. There were no other symptoms. I detected no fulness in the right side, but on making a rectal examination found a large tumor above the prostate. The diagnosis of deep pelvic abscess was made, but was considered so doubtful, I think, that when I proposed to the house physician that he should operate, he was not at all anxious to do so. A knife passed into the tumor through the rectum made the diagnosis quite plain by the evacuation of eight or twelve ounces of fœtid pus.

I have seen these abscesses in young children—once in the case of a boy of five years—and several times before the age of puberty.

The diagnosis will in not a few cases be made only after there has been a free discharge of pus by rectum, bladder, or vagina, but rectal examination in cases of obscure pelvic pain cannot be too strongly insisted upon, as it will often render an otherwise obscure case perfectly plain. It must not be forgotten that pus in this location may form entirely independently of the rectum, and may be due to appendicitis, to caries of some adjacent bone or of the spine, or even to suppuration around the kidney or liver.

The prognosis is always grave. The patient is exposed to the dangers of pyæmia, peritonitis, and phlebitis, and, even should the pus find a favorable point of exit, to the exhaustion of prolonged suppuration with its secondary visceral complications. When the abscess finally heals there is also danger from the cicatricial contraction, resulting, as it sometimes does, in occlusion of the rectum high up; but abscesses in this locality, even after free opening, may refuse to heal on account of the constant motion of the parts in every act of respiration.

According to the statistics of Ségoud, 35 of these abscesses per-

forated the urethra and 77 other parts, generally the rectum, but occasionally the perineum, the ischio-rectal fossa, and the obturator foramen. 20 per cent. were fatal, and many left fistulous communications with the rectum or urethra which did not heal.

The treatment may be included in two words—incision and drainage. My own rule is to cut at the point to which the pus seems naturally to be tending, whether in the rectum, vagina, or peritoneum, or above Poupart's ligament. The incision must be free enough to permit not only the escape of pus, but the introduction of one or two fingers to clean out sloughing tissue, the introduction of suitable drainage and of free irrigation. A careful dissection from the perineum into the abscess-cavity has been recommended as affording the best possible outlet, but this is not always practicable, nor will an opening made here always prevent the pus from subsequently finding its own way out at a different point.

Fistula.

Fistulæ, like the abscesses of which they are the remains, may be divided into superficial and deep, or those of the skin and subcutaneous tissue, which involve only the external sphincter muscle, and those of the rectum proper, which have their internal openings higher up in the gut and arise from abscesses of the ischio-rectal fossa and the pelvi-rectal space. Each of these classes may also be divided again into three different forms—those which have an external opening only, those which have only an opening into the rectum, and those which have both, though these distinctions are of but little practical importance. There may be two or three external openings in a small subcutaneous fistula and no internal opening, and scarce any two fistulæ are alike.

The external orifice of a small fistula may be so small as to escape detection in a cursory examination, and may keep the parts soiled with a discharge the origin of which may be hard to discover. To the educated finger the internal orifice is generally appreciable as a small raised papule between the two sphincters. In any case where the existence of an internal opening is in doubt milk may be injected into the track or abscess-cavity through the cutaneous opening. If the milk finds its way into the rectum, the proof is complete, but I do not know that it is of any special value.

Mistakes in the diagnosis of fistula are most likely to occur where an internal opening alone exists. The patient complains of pain and discharge of pus and mucus *per rectum*, and yet examination reveals nothing. These are the cases that go for years from one doctor to another without relief, and the secret of the diagnosis will be found to lie not in speculum examination for the cause of the discharge, but in

careful digital palpation of all the parts for deep induration. A lump may be felt under the skin, which, being pressed upon, will cause a flow of pus into the rectum; or when the finger is passed into the bowel a distinct swelling may be detected under the mucous membrane, and with a speculum to hold the anus open the orifice can be detected by pressing a few drops of pus out of it.

These are very interesting cases. Sometimes a small ulcer marks the internal orifice of such a fistula and completely deceives the examiner, but the ulcer never heals till the track leading away from it is found and laid open. I have seen a number of such cases as these following the injection treatment of piles; and indeed this constitutes one of the great objections to that treatment. The carbolic acid placed in the substance of the tumor causes a small slough and some burrowing in the submucous tissue. An ulcer of greater or less dimensions and a fistulous track an inch or so in length, running upward from the ulcer, are the results, and the patient is in a much worse condition than before.

There is another variety of fistula with an internal orifice only, which has a special pathology. A tubercular deposit in the glands of the rectal mucous membrane softens and leaves a small ulcer. The ulcer, constantly subject to irritation, perforates the wall of the gut, and sets up an abscess in the perirectal cellular tissue, and a fistula with internal opening results. In these cases the pathology is generally plain, from the fact that the opening is much larger than it would be did it represent merely the point of breaking of an abscess. The finger in the rectum in such cases shows a large ragged orifice in the wall of the gut through which the end of the index finger readily enters an abscess-cavity.

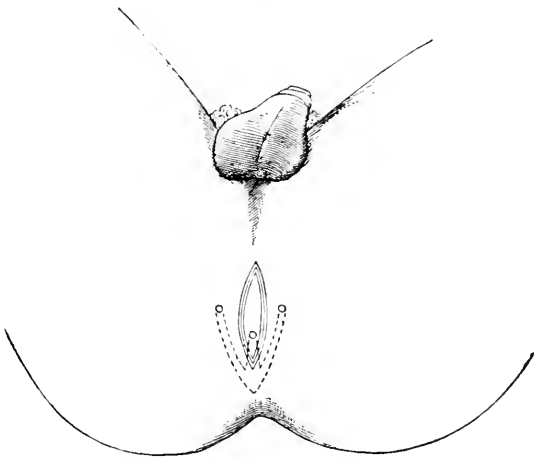
Fistulæ resulting from abscess of the ischio-rectal fossa vary greatly in extent. The track is apt to be double or branching; the internal orifice may be far below the upper limit of the disease, and the external one a considerable distance from the anus. The whole perineum and gluteal region may be found brawny and perforated with openings, sometimes as many as twenty being present, and pressure over one trochanter may cause pus to flow from an opening opposite the other.

The fistulæ resulting from deep pelvic abscesses are all of them severe, and many are incurable. The track in some of these cases has been known to lead a long distance from the origin of the disease, as in Astley Cooper's case, where there was one opening in the groin and the other near the anus, the pus having followed the course of the spermatic cord. Cases where the pus has burrowed entirely under the gluteal muscles and finally appeared in the thigh or down by the popliteal space are not very uncommon.

The term "horseshoe" fistula has been used to describe a class of

fistulæ which are not uncommon. In a general way it applies to any abscess-cavity or fistulous track which surrounds the rectum in a semicircle, either in front or behind. In a typical case such an abscess-cavity will have one opening on each side of the anus, and one into the rectum in the median line behind, but the openings may be anywhere

FIG. 66.



Fistula with Two External Openings.

or in any number, the only essential being that the pus in its burrowing has partially surrounded the gut.

After the diagnosis of the existence of fistula has once been made, there is little to be gained by careful probing before the patient is under ether at the time of operation. Such probing is painful and practically leads to little good. When the time comes to operate, it is generally early enough to decide upon the extent of the disease and upon the presence or absence of an internal orifice.

With regard to operation there are several points to be decided. Fistulæ may sometimes be cured without cutting. Small straight tracks with an external orifice may be stimulated by the application of irritants to healthy granulation, and may even close spontaneously. Applications of nitrate of silver fused on the end of a probe, injections of tincture of iodine in greater or less strength, the introduction of laminaria tents, or packing the abscess-cavity with charpie have all been effectual in some cases; but none of them can be relied upon with much confidence, and all require a good deal of time and patience.

Another question which will often be asked is whether it is safe or best to operate, and the answer to this is that it is always best to operate where a cure is possible. This question arises most frequently in connection with tubercular deposits. There is no doubt in my mind that

when the tuberculous deposit in the rectum is the primary and only one, the generalization of the disease may be prevented by an early and radical operation. Such cases, however, seldom present themselves. In general, the tuberculosis in the rectum comes after the pulmonary deposit, and here the question of the patient's powers of recuperation after the operation is all-important. It is hardly worth while to subject a patient to much of a cutting operation in the late stages of pulmonary tuberculosis, for there is very little chance that the fistula will be cured. The constant cough acts mechanically to prevent this, as well as the general condition of malnutrition, and to give any chance of cure the operation must be sufficiently thorough to destroy whatever tubercle may be deposited in the fistula. My own rule of practice, therefore, is to operate in all cases in which I believe that the patient's general and local condition admits of a fair chance of healing. Of course the patient may go on and die of his pulmonary tuberculosis, but I have never seen a case where I had reason to believe the curing of a fistula hastened this end by a single day.

There may be other reasons for not operating besides tuberculosis. The patient may be in no condition from other organic disease, and the fistulous burrowing may be palpably so extensive as to be beyond the patient's recuperative powers. Where the fistulous openings exist in great numbers, fifteen or twenty, two or three operations may be better than the attempt to cut all at once. In such cases careful examination will usually show two or three main foci of trouble with small side-tracks and diverticuli, and these may be attacked successively.

For some time I have been teaching that an operation for fistula should be done exactly as a careful dissection for one of the nerves or vessels of the perineum should be, and that a fistula is not a track with two openings through which a director is to be passed, and which when slit open will be cured. The man who operates with this latter view in mind will fail to cure all but the simplest cases.

Beginning at the cutaneous opening when there is one, the abscess-cavity or indurated track, as the case may be, is to be followed up with the knife inch by inch, no matter where it leads, till all parts are fully exposed, if the operator expects a cure; and great skill may be shown in doing this without doing more injury to the perineum than is necessary. Incontinence of fæces from division of the sphincters is a thing always to be borne in mind, and avoided if possible, and a good operator will succeed in doing this where an unskilful one will fail. In a lady, for instance, the doctor will receive no thanks for converting a comparatively painless and trifling sinus into a condition of incontinence of wind and fæces, which renders the patient unfit for society for the rest of her life.

The majority of cases of fistula, even of the bad cases, may be

cured by a skilful operator by a single division of the sphincters, and many without dividing them at all; and a single division even of both muscles, more especially if made in the median line, seldom results in incontinence. A double division of both muscles is more than likely to result in more or less permanent loss of power, and especially is this the case in women. There are cases, to be sure, in which such division is absolutely necessary for a cure, but these patients should be warned of the possibility of such a result beforehand.

Take, now, a simple case of fistula with an external opening an inch to one side of the anus, an internal one just within the sphincter, and a straight track connecting them. No operation could be simpler than the following of this track with the knife and laying it open to the sight. The lardaceous tissue composing the secreting wall of the cavity should then be scraped away, and to excite healthy repair the back wall and sides of the cavity should also be incised down to connective tissue. Much time will be saved by this free incising of the other parts of the secreting cavity after the first laying open. The wound needs scarce any dressing. A little iodoform gauze placed in the incision, and left for a couple of days, will prevent union of the lips of the incision by first intention (an accident I have known to render the operation entirely useless), and after this the wound may be left to granulate from the bottom, care only being taken to keep the edges open and to prevent the formation of fresh pockets or sinuses. The wound is treated as an open one, and only stimulated or cauterized as its appearance may indicate.

This is essentially the treatment of all cases of fistula, but the modifications are many.

In a few cases we may try to save time by securing union by first intention, not of the lips of the wound, but of the whole abscess-cavity and the incision. In the simpler cases of straight tracks without diverticula this may occasionally be done. The pyogenic membrane must first be entirely dissected out, and the parts then carefully brought into apposition—first with deep sutures of silkworm gut, and then with superficial ones. This procedure is adapted only to the simpler cases, and in these will fail oftener than it succeeds.

Supposing such a fistula as has been described to be of tubercular origin, a more radical operation is necessary. Here, after laying the whole extent of the disease open to the light, it is my practice to apply the Paquelin cautery to the entire abscess-cavity, and to trim off the overhanging bluish edges which only prevent union and have not sufficient vitality to be of any help in the healing process. The hot iron is very effectual, and yet does not burn away too deeply to accomplish the desired end.

Supposing that after commencing the dissection of a fistula at the external orifice, and following it up toward the rectum, no internal opening exists. In such a case the operator must be guided in his further steps by the amount of tissue between the end of the track and the mucous membrane. If nothing separates the gut from the abscess but mucous membrane, as can easily be decided by a finger in the bowel, the director should be forced through this slight separating wall at the highest point of the abscess-cavity and the rectal wall should be divided out through the sphincters, for the simple reason that where the burrowing has advanced as near to the cavity of the bowel as this it will, in the vast majority of cases, go on and perforate in spite of any amount of external incision; and when this has occurred the external incision will fail to cure.

Supposing, now, that an internal orifice exists, but no external one. Here the operation is manually more difficult, but the essential principle the same. A bent probe is passed into the internal opening and the general direction of the track determined. If it approaches the surface, all is well, and it may be cut open from the skin. The blind internal fistula is thus changed to a complete one, and operated upon as in the former case. In some cases it will be difficult, this manœuvre of the bent probe, and in such I have often cut boldly into the subcutaneous induration which marked the site of the abscess at first, and then found no difficulty in passing the director from the internal orifice out through the skin incision.

In another class of cases the probe in the internal opening will indicate that the track runs upward under the mucous membrane, and not outward into the cellular tissue. These also should be cut.

In still another class of cases the probe will enter a large abscess-cavity high up in the pelvis in the cellular tissue. These are the bad cases, and may be incurable. The abscess-cavity may be too far away from the surface to be opened in this way. In such cases under ether the opening into the gut must be enlarged with the finger or a pair of dressing-forceps, the abscess-cavity thoroughly irrigated with strong biehloride solution, and a drainage-tube left in for daily irrigation. Many will heal by a daily introduction of the finger to keep the orifice dilated and a thorough irrigation, but some will not. In women some of these may be treated by complete extirpation by abdominal section, but some of them cannot be cured. I have one now under observation in which I have already done colotomy with great benefit for a stricture of the rectum. In addition to the stricture, however, there is a large abscess in the left side of the pelvis communicating with the rectum, and the discharge from this, consisting of a couple of ounces of clear pus daily, comes up by reverse peristalsis, and is evacuated from the artificial anus. In this case I

propose to do a laparotomy for the sake of getting at the abscess and trying to induce it to heal.

Even in the more superficial cases there are some rules to be followed which increase the chances of success in operating. It will not infrequently be found that the internal orifice is not at the upper limit of the disease, but that just before the fistula perforates the bowel another track branches off in an upward direction, and extends some distance either under the mucous membrane of the rectum or in the cellular tissue outside of the rectal wall. This sinus also must be cut to ensure a successful operation. When it is merely submucous, the cutting will cause only slight hæmorrhage, for the vessels of the rectum are outside of it; but when the entire rectal wall has to be divided there may be sharp bleeding from one of the hæmorrhoidal arteries. In these operations, however, where it is proper to go with a knife it is also possible to follow with artery-forceps and ligatures, or, failing with these, the bleeding can always be controlled by a systematic packing of the rectum. For doing this a special instrument has been devised, shown in the cut. A bell-shaped sponge is tied tightly by its

FIG. 67.

Canula for Packing the Rectum.

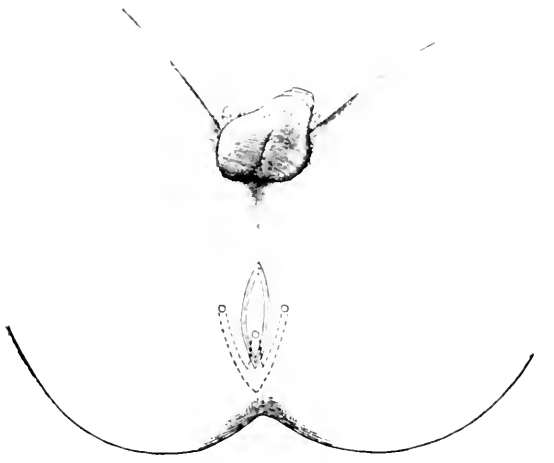
apex into the groove near the eye of the canula. This is first moistened, then dusted well with the dry subsulphate of iron, and introduced above the bleeding point. Into the cavity of the sponge dry charpie dusted with the same powder is next tightly packed, till the rectum is filled down to the sphincters. Pressure against the anus with one hand and traction on the tube with the other will pack sponge and charpie into one compressing mass which will effectually control the bleeding; the canula will allow the escape of gas and fluid fæces, and, although uncomfortable, with the aid of an occasional dose of morphine the packing may be left in a week or longer.

When the operator is afraid to cut thus freely into the upper part of the rectum, either on account of bleeding or in dread of opening the peritoneum, a long-bladed enterotome may be used to divide the tissues, or the elastic ligature may be used and left to cut its own way out; but a good operator will usually divide what it is necessary to divide with the knife, knowing always that in an emergency a posterior

division of the gut down to or beyond the coccyx will enable him readily to reach every part, and will add no risks.

Mr. Goodsall of St. Mark's has devoted much thought to the

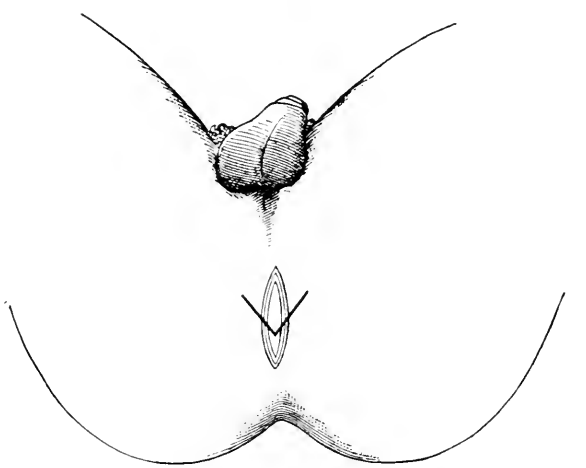
FIG. 68.



Fistula with Two External Openings

question of operating upon complicated fistulæ without doing more damage to the sphincters than is necessary to effect a cure. In the above diagram (Fig. 68) his practice is exemplified. It represents a typical

FIG. 69.

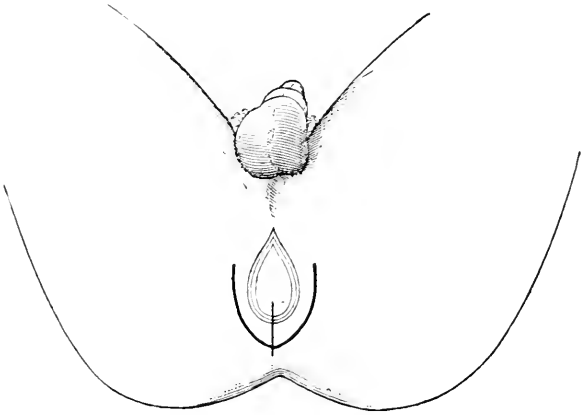


Usual Operation for Fistula shown in Fig. 66.

horseshoe fistula, with one opening on each side of the anus and a single internal orifice in the median line behind. The ordinary incisions

which would be made in such a case, and which would divide both sphincters twice and laterally, so that incontinence would almost certainly result, are shown in Fig. 69. But the track may be completely laid open by a single division in the posterior median line, as shown in Fig. 70.

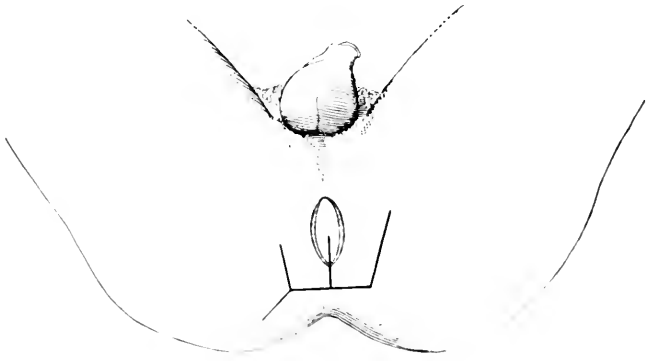
FIG. 70.



Correct Incisions for same.

A more complicated case of the same variety is shown in Fig. 71, where there are five external openings and one internal one. Imagine the destruction of the sphincters which would result from following the

FIG. 71.

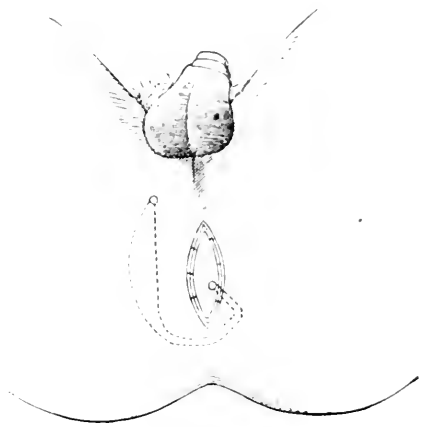


Incisions for Multiple Fistulæ.

rule of operation generally given in surgical textbooks—to pass a director from the external to the internal openings and cut upon it. The incisions by which this also can be cured are shown in Fig. 71. In Fig. 72 is shown a fistula in which to follow the usual rule would not only be almost impossible, but would result in an amputation of

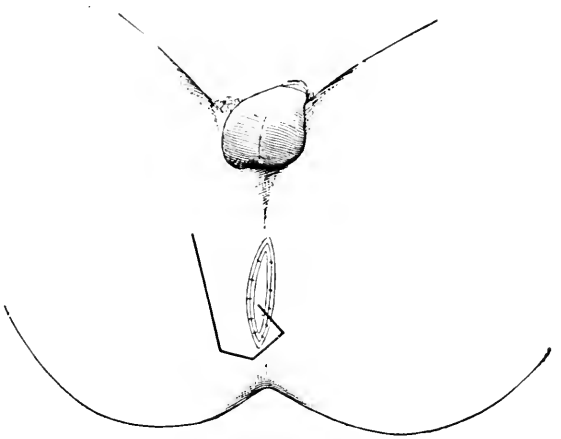
at least two inches of the bowel for three-quarters of its entire circumference. And yet the laying open of the abscess-cavity in its entire extent was a simple matter, by the cut shown in Fig. 73. This principle may be carried out in almost all operations, and yet there is one class in which the division of all the sinuses is not permissible. There is a form of this disease due to abscess of the vulvo-vaginal glands in which openings for the escape of pus are apt to form both in the labia and in the rectum. Such a case is shown in Fig. 74, where there was one opening in each labium, and two sinuses leading from these into the rectum, with cross-communications in the substance of the rectal wall. It is evident at a glance that a free division of these sinuses would mean two complete divisions of the entire perineal body, with the sphincters. In that case the cutting was done

Fig. 72.



Horseshoe Fistula.

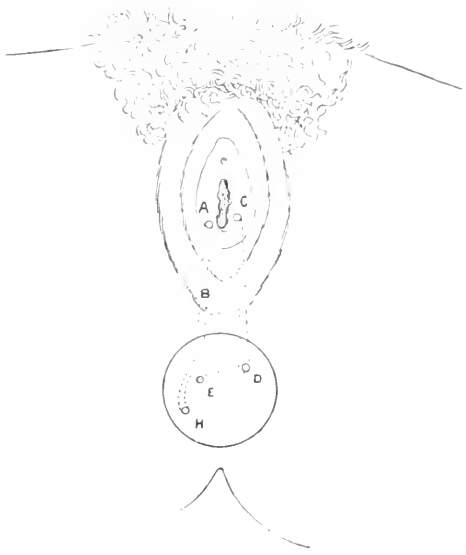
Fig. 73.



Incisions for Fig. 72.

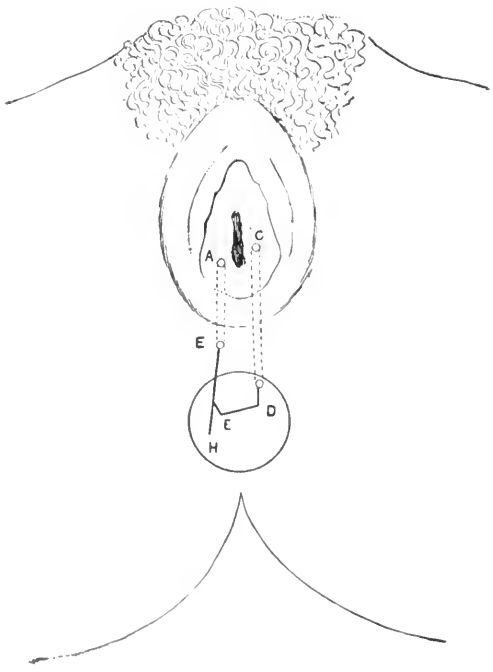
as follows: A probe was passed into the sinus at A, and forced out through the skin at B, the opening at B being made for the purpose of the operation, Fig. 75. The sinus from B to E and H was then

FIG. 74.



Recto-labial Fistulæ.

FIG. 75.



Incisions for Fig. 74.

divided, this cut involving of necessity the external sphincter, but not all of the internal. The submucous sinus E D was also divided, the opening D being just at the verge of the anus, and the incision not implicating the sphincters. Through the sinuses A B and C D setons were then passed, and allowed to remain till they had excited healthy reparative action along their tracks. The result was completely successful and there was no loss of control.

The directors used for these operations should be of steel and of a special pattern. The difference between the ones in general use and the proper ones is shown in Figs. 76 and 77.

Fig. 76.

Ordinary Director.

The cause of incontinence after operations for fistula has been the subject of considerable argument. In some cases a single incision

Fig. 77.

Proper Director for Fistulæ.

through the external sphincter has been followed by this untoward accident, while in others extensive and numerous incisions have still left the patient with good control. The explanation probably lies in two factors—one the division of the nerve-supply, which may be quite complete, by a comparatively slight incision; and the other in vicious cicatrization, by which the ends of the divided muscular fibres are not brought into apposition in healing.

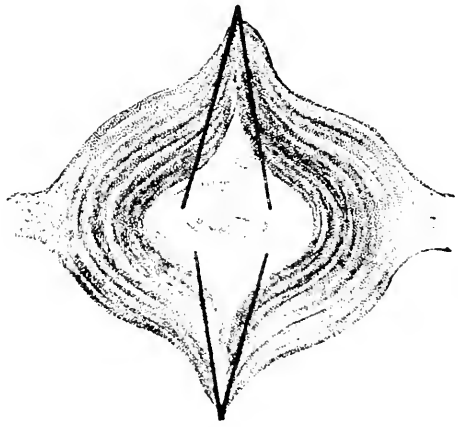
The condition is one which entails a greater or less degree of discomfort, depending mainly on the regularity of the patient's bowels. I have already spoken of this question of sphincteric action, and need not repeat it. When the patient is in the habit of having one daily solid evacuation of the bowels, he may never realize the incompetency of the sphincters. On the other hand, a patient with diarrhœa will be very miserable and unfit for society. The most grateful patient perhaps any man ever had is a lady who suffered from this, and, secondary to it, from prolapsus and a good deal of intestinal catarrh with diarrhœa, who had been confined to her house for twelve years because she could not trust herself away from the conveniences of her own home. The case was a simple one, in that the rectum had been torn into in parturition, and, though the superficial parts of the perineum had been repaired

perfectly, the ends of the sphincter had been left out. Freeing these and approximating them by a few sutures resulted in perfect control.

In the treatment of this condition the operator has abundant scope for ingenuity, and it is well to be guarded in his promises as to immediate cure. I have been successful in some interesting and important cases, but I always tell the patient that I will do what I can, and that it may be necessary to operate two or even three times. Some will be seen at a glance to be manifestly incurable—such, for example, as have no sphincter remaining, or those in which the anus has been cut over and over again till the sphincter consists merely of a number of atrophied short segments connected by dense cicatricial tissue.

The operation in a general way consists either in tightening the anus by the application of the cautery at various points, or in excision of old cicatrices and suturing the divided ends of the muscular tissue. Sometimes a combination of the two methods may be resorted to. The cautery when used is applied at three or four different points in the circumference of the anus, and deep burns are made through the sphincter down into the cellular tissue, which by their cicatricial contraction will pucker the orifice. In this way the anus may be tightened to any extent, and a combined action of all the muscles will give the patient ability to retain solid evacuations for a longer or shorter interval. Of real sphincteric action, however, there will not be very much, though the patient's condition may be vastly improved. When, however, as shown in Fig. 78, there has been faulty cicatrization, and the cicatrices can be dissected out and the ends of the muscles brought into perfect apposition, a much better result is possible, and perfect control under all circumstances may be obtained. As I have said before, there is ample room for the exercise of ingenuity and patience, but no class of cases is more satisfactory where appreciable good is accomplished.

FIG. 78.



Incisions for Fæcal Incontinence.

HÆMORRHOIDS.

For convenience it is better to divide hæmorrhoids into external and internal, and to treat of each separately.

External hæmorrhoids may be composed almost entirely of hyper-

trophied skin and connective tissue, with a free vascular supply, or of enlarged blood-vessels and extravasations of blood, without connective-tissue hypertrophy. The two varieties are totally different in their characteristics, as is shown by a glance at Figs. 79 and 80. Consider first the tag of skin and connective tissue shown in Fig. 79. This is almost always the result of some irritation, proceeding perhaps from the rectum, such as ulceration, or from the discharge from a fistula. When uninflamed it is painless, but it is liable to attacks of acute inflammation and suppuration, and sometimes small subcutaneous fistulæ may form in its substance.

Fig. 79.

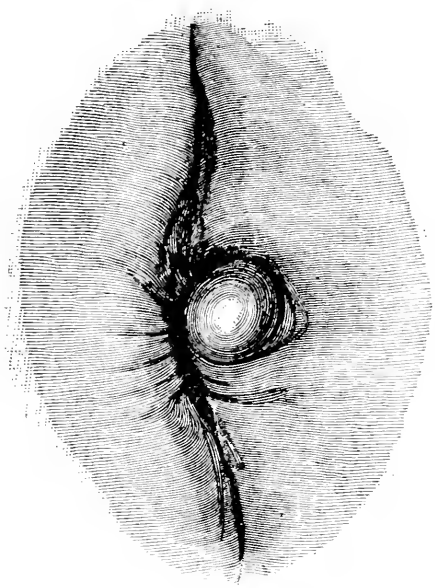
External Cutaneous Hæmorrhoids.

This form of trouble, when demanding treatment, as it seldom will except in nervous patients, is best met by simple amputation with curved scissors. The bleeding will be slight and controllable by pressure for a few minutes. Cocaine may be injected into the substance of the tumor before cutting. To those whose tendencies are toward carbolic-acid injections let me give a word of warning against their use in this and the following forms of the disease, for they will almost invariably lead to suppuration and make the patient very miserable. When these tags are acutely inflamed also, it will generally be found to save trouble to amputate them rather than to incise them.

The second form of external hæmorrhoids is an extravasation of venous blood into the delicate connective tissue of the margin of the anus. Instead of a tag of skin there is a round, exquisitely sensitive, venous tumor, showing plainly the dark mass of clotted blood through the stretched and delicate covering. Such a tumor may come on quite suddenly after straining at stool or a night's debauch. At first it causes uneasiness, then pain. The patient vainly endeavors to relieve himself by pressing it up into the rectum, and, though pressure for the moment accomplishes this, the tumor reappears at once. After days of discomfort such a tumor will either shrivel up and leave a small tag of the first variety, or the clot will break down and suppurate; there will be a slight discharge of pus and almost instant relief.

In sensible persons the suffering caused by this condition can be instantly relieved by passing a fine, sharp bistoury through the tumor and turning out the clot. This is about the only operation in surgery I ever perform without the patient's consent. Otherwise, the sufferer must be put to bed, the liver freely acted upon by podophyllin, and the painful little tumor treated either with ice or hot poultices as may seem to give the most relief.

Fig. 80.



External Venous Hæmorrhoids.

There is a form of internal hæmorrhoid which stands alone. It is the slightly raised collection of arteries and veins which strongly resembles a nævus. It never forms much of a tumor, nor is it apt to occasion pain, but it bleeds on the least provocation, and sometimes nearly exsanguinates the patient. A movement of the bowels is enough to start the flow, and then, if an examination be made, the blood will be seen issuing in a jet from what seems to be only an eroded surface the size of a finger-nail. This form of disease is also readily cured, and, to the patient's delight, it can always be done "without operation." With a speculum in the rectum the spot is first dried with a pledget of cotton, and then thoroughly painted with fuming nitric acid on the end of a match. One such application well made will suffice for a radical cure; and this, by the way, is the only form of hæmorrhoid in which applications of nitric acid are likely to do much good, although at one time this form of treatment enjoyed a good deal of popularity.

Coming now to internal hæmorrhoids proper, we find them made up of masses of enlarged veins and connective tissue, forming distinct tumors springing from the rectal wall just above the external sphincter. When uninflamed and not eroded or ulcerated, they cause little pain, but they prolapse at stool, are sometimes difficult to replace, bleed more or less freely, and may excite an exaggerated train of reflex symptoms in any part of the body connected by its nerve-supply with the sacral plexus.

In the treatment of this condition there are several points to be considered. First, as regards palliation. Many sufferers will not

submit to a radical cure, and for them it is possible to do something by simple means, though perhaps without much satisfaction. Patients with hæmorrhoids should be careful as to diet and avoid alcohol, which either by its irritation of the alimentary canal or its action in causing congestion of the liver has an immediate bad effect. When a patient comes for treatment with a history of late excesses, the first thing to be done is to unload the portal circulation by active catharsis. Next, the tumors may be treated by certain local applications. The best astringent is cold water freely applied to the parts after defecation every day. In addition to this a suppository or an ointment of subsulphate of iron may be either smeared over the tumors when prolapsed or introduced into the rectum. This will sometimes in great measure control the bleeding. Perfect regularity in the evacuations must also be secured; and when these measures have been carried out, about all has been done that can be done without radical operation.

Occasionally there arises a condition of complete or partial strangulation which requires a word. The patient with large tumors finds, to his surprise, that they have come down and cannot be replaced as usual. After bruising them for a time in the attempt he leaves them to go up of themselves, and goes about his duties. Soon they become painful and swollen, and after a few more attempts at reduction he sends for a doctor. By this time the tumors may have become partially gangrenous.

Here also we have two plans of treatment to choose from. My first attempt is always directed toward taking advantage of the patient's extremity and getting him to submit to a radical operation. The condition of the parts is not a contraindication to operation, though care must be exercised as to the amount of tissue to be removed. Failing in this, the first thing is to accomplish reduction if possible. With the patient on his face in bed and the buttocks raised upon pillows, the tumors are first greased with sweet oil. Taxis should then be employed as in hernia, the last part down being the first to be put back. It is better to confine the effort to one part of the mass, for if this will go up the rest will follow. Taking, then, some one prominent point on the ends of the first two fingers, gentle continuous pressure is made, and as the part disappears within the anus the fingers follow it well up into the rectum. If this can be done, the remainder can generally be reduced, section by section, in the same way.

Should this fail, give the patient a sufficient quantity of ether or chloroform to produce primary anæsthesia, and dilate the sphincter till the mass can be reduced. If this is refused—and it sometimes will be—leave the man in bed, give a cathartic, put ice or hot poultices on the parts, and in a week or so they will subside. If sloughing occur, it will go far to effect a radical cure.

In a work of this nature it is manifestly impossible to consider all of the possible ways of radically curing hæmorrhoids, and it will suffice for our purpose merely to describe those most generally found reliable. Of these there are two which will always cure with very little danger, and which have given entire satisfaction for many years; and every practitioner will choose for himself between the ligature and the clamp.

The operation with the ligature owes its deserved popularity to the influence and practice of the elder Allingham at St. Marks. Briefly described, it consists in dissecting off the pile from the muscular tissue with the scissors till its upper part is reached, where its chief blood-supply is received, and in tightly tying the remaining pedicle with a strong ligature, both pile and ligature being then cut short.

This is an operation as safe and as certain of cure as any in surgery. It is quickly and easily performed, is little likely to be followed by accidents, has scarce any mortality, and is in every respect satisfactory. The objections to it are that it sometimes causes a good deal of after-pain—pain which I have accounted for by the ligature of nerve-filaments in the pedicle.

In striving to find some equally satisfactory and safe method of radically curing this disease I was led to experiment with another operation, also sanctioned by good authority, and which I hoped might not be attended by the same amount of after-pain as the ligature. In the operation with the clamp and cautery I believe I have found it, but this is all that I claim for this operation over the ligature. Did I not use the clamp, I should always use the ligature, and by either method every case of piles may be cured where any operative procedure in indicated.

My own operation with the clamp and cautery I adopted on the recommendation of Henry Smith of London. I claim no originality in it, except as every operation will be slightly modified in technique by the individual operator; but I do believe that by it a radical cure can be effected as safely (and no more so) as by the ligature, and more especially that my patients suffer less during convalescence than do those operated upon by the ligature. This I am in the habit of accounting for by the fact that no nerve is tied up in a string—that sensibility in the pedicle of the tumor removed is in great part destroyed by the application of the actual cautery. I believe also that there is less reflex irritation, that the catheter has less frequently to be used, and that my patients are altogether more comfortable than those operated upon by the ligature.

Of course pain is more or less relative, and in the settlement of such questions as these large numbers of cases must be compared. I do not wish to convey the idea that the operation performed by myself is painless, for occasionally a nervous patient will complain a good deal

of pain for several hours; but it is an unusual thing in my own practice to give any morphine after the operation or to have to resort to the catheter. It is not long since I operated upon an active business-man in the afternoon, and in the early evening found him sitting up in bed presiding at a directors' meeting, having eaten a good dinner, and smoking a cigar. My students at the Post-Graduate Medical School are not at all surprised to see these patients dress and come down stairs to show themselves to the class forty-eight hours after the operation. I never refuse to allow a patient to dress himself and be about his room on the second day, and most of them prefer to do so. This is all the advantage that I claim for the cautery over the clamp, and this claim I believe to be well founded.

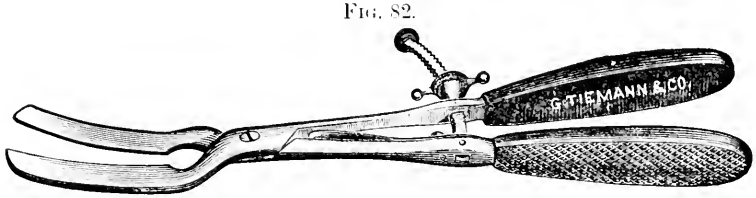
I find that no verbal description will teach all men how to perform this operation, which is one of the simplest, and I must confess to never having seen anybody else perform it except under my personal supervision. Very early in my experience I modified the clamp of Smith to suit my own ideas, and abandoned entirely his different forms of cautery-irons for a simple medium-sized point of the Paquelin cautery. There are but four instruments necessary for the operation—the clamp, cautery, a long pair of scissors, and long double-pointed forceps after the general pattern shown in the cut.

Fig. 81.

Forceps for Hæmorrhoids.

The sphincter is first sufficiently dilated to allow of bringing down the piles outside of the anus with the forceps. If the tumor involves the margin of the anus, and if it is desirable to remove a portion of the skin of the anus with the pile, a groove is made in the skin with

Fig. 82.



Author's Clamp.

the scissors, otherwise they are not used. In the groove thus made the clamp (Fig. 82) is applied, the tumor to be removed being drawn well downward by the forceps. This groove answers exactly the same

purpose as the cut made by Allingham for the ligature. It prevents the burning or crushing of healthy skin, exactly as it avoids including it in the ligature. With the clamp in position the mass of the tumor to be removed is cut off with the scissors, care being taken to leave a good substantial stump outside of the bite of the clamp for the application of the cautery. During this cutting the clamp acts merely as a temporary ligature to prevent bleeding. It is not at all a crushing instrument, and has only sufficient force to prevent the pedicle from slipping out of reach, and to control all hæmorrhage while in position. The cautery is then applied freely to the stump left by the scissors, till it has been burned down even with the surface of the clamp. The object of the cautery is simply to prevent bleeding after the clamp is removed. It is well to relax the clamp slowly, and see if the cauterization has been sufficient for this purpose. If no bleeding point appears, the clamp may be entirely removed and the burned stump allowed to slip up into the rectum. Should any vessel not be closed, the clamp, being still in position, is immediately tightened and the cautery applied again. It will be seen by the cut that the instrument is provided with a screw for keeping the blades closed. This may be useful, but in ordinary cases is of no value. The instrument is controlled entirely by the left hand, the handles being made long and strong for this purpose.

There are several points which I find need special attention in this operation. I found not long since that they were practising it in Toronto with results not at all satisfactory. There were great pain, inflammation, and some sloughing after the operation. I had occasion to operate on one of the medical gentlemen of that city, and could only persuade him to submit to it with difficulty. After convalescence the difference between his own case and those he had seen was so great that he determined to see me operate on somebody else, and the reasons for the difference became manifest. In the operations he had seen the clamp had been passed into the rectum parallel with its axis, and the cautery had been passed up after it to do its work. It will be seen that my clamp has no ivory shields, as has Smith's, to protect adjacent parts. The parts need no protection, for the piles are brought outside of the anus, and the clamp is applied across the orifice, not within it.

There is said to be danger of hæmorrhage from this operation. I have known of one case of fatal hæmorrhage a few hours after it, but I have known of many cases of hæmorrhage after other operations improperly performed.

The application of the hot iron to a bleeding surface is still considered a good hæmostatic in suitable cases; why not in the rectum? And yet I can easily see how an unskilful operator may have bleeding after this method. It will be seen that my clamp does not shut parallel,

and when a large mass of tissue is in the heel there will be very little pressure upon that in the grasp of the end. Cutting off such a large mass will sometimes allow of some escape of the stump from the point of the instrument. That which remains is cauterized; there is a spouting vessel in the end of the cut that has escaped the cautery, and bleeding results. If the clamp is put on with the heel up the rectum and the point at the cutaneous margin of the pile, the bleeding point must be at the surface. If put on in the reverse direction, which is a little easier, the bleeding point will be high up in the bowel.

The only answer to this is that leaving a spouting vessel in the stump without applying the cautery to it is not the clamp-and-cautery operation, and is a decidedly reckless and unsafe piece of surgery.

I have great faith in these eschars myself to prevent bleeding—so great that after every operation I introduce a large speculum, dilate the bowel, and irrigate it thoroughly with bichloride solution. If there is any bleeding, I see it and go back after it, and I teach my students never to leave such a rectum till they are sure there is no bleeding from within it. The cutaneous incisions with the scissors will bleed some, and this is controlled by pad and bandage.

One other point to be guarded against: this operation is capable of producing a stricture of the anus. So is the ligature or any other where tissue is removed. The clamp should not be recklessly applied to the entire circumference of the anus, but small intervals of sound mucous membrane should be left at least at two opposite points. The operation is applicable to the most severe cases, and sufficient tissue can always be removed to cure without causing undue contraction if proper care be used. Should stricture result, it is not a very serious affair, and is very easily cured by proper dilatation.

After the operation a pad of lint and a T bandage are tightly applied. In a couple of hours these may be removed, and a poultice substituted, which will relieve the pain. I make no attempt to confine the bowels after operation, and give a laxative at the end of forty-eight hours to secure a passage. With average rest and quiet cicatrization will be complete in about three weeks. During the first week I try to keep my patients in the house, but afterward they attend to their usual duties, unless this requires them to be much on their feet, in which case I insist upon longer rest and watch the healing process much more carefully.

There is little more to be said. The dangers of this method can easily be seen and as easily avoided. I have never had an unpleasant experience with it, but no operation is perfectly safe in unskilful hands. Sometimes, when the sloughs separate, I may have a fatal case of secondary hæmorrhage, and so may anybody else with the ligature about the tenth day, when it comes away. I spoke of one fatal case

of primary hæmorrhage, and that this may not have undue weight against my favorite method I will mention that not long ago there was a death in one of our largest and best hospitals from the same cause—after the ligature. Neither is to be laid to the operation—both to the operators.

So much interest is felt by many in the method of treating hæmorrhoids by injections of carbolic acid or other substances that it may be best to devote a few words to it before closing the consideration of this subject.

The method is well understood by the profession at large, and it has its advantages, which, however, are more than counterbalanced by its risks. The advantages are, that, by what seems to the patient a trifling and, for the moment, painless puncture of a needle, his piles may be greatly relieved. The disadvantages are that the injection of an irritant fluid into the substance of a vascular tumor is liable to set up a good deal of trouble. The remedy is too uncertain in its results to be recommended. Many cases are quite satisfactory. There is apt to be a good deal of pain following the injection, coming on in the course of a few hours and lasting some days; but the mild amount of inflammation thus set up results in hardening and shrinking of the tumor, so that for a time it neither bleeds nor protrudes. The relief thus obtained may last two or three years, after which the condition will be the same as before.

If this amount of palliation could be secured without risk to the patient, the treatment would be a most excellent one; but, unfortunately, such is not the case. Great pain often succeeds the injections—pain sufficient to confine the patient in bed and render necessary large doses of opium. In many cases the injection will cause a slough, and when the slough separates there may be severe hæmorrhage, and a ragged ulcer remains, requiring careful treatment for its cure. If the slough be circumscribed, the patient is apt to be cured of that particular hæmorrhoid; but there is often burrowing, and a class of blind fistulæ with internal openings results which cannot be cured without operation.

In many cases small marginal abscesses result. These, in my experience, have not been larger than the end of the thumb, have always been just at the margin of the anus on the same side as the pile injected, and unless freely opened have made small subcutaneous fistulæ. They are not situated at the point of puncture, but lower down.

Finally, when an inflammation is started in the walls of the rectum, no man can limit its extent, and either a circumscribed or general periproctitis may be the result. Large abscesses may form, the patient has the usual signs of septic poisoning, the lymphatics in the pelvis and groin

become involved, and if the patient's life is saved, it is only by good luck and bold surgery.

All these accidents have occurred after injections made by myself, and others have reported fatal results. For these reasons I have practically abandoned the treatment, and yet it has its fascinations. Not long since a woman came to my clinic complaining of the loss of blood from the rectum. She was just at the end of the third month of pregnancy, and was covered with an early syphilitic eruption. It was impossible to operate on her hæmorrhoids, and for the sake of showing the class how it was done I made three injections of a 10 per cent. solution of carbolic acid at intervals into three tumors. The result was perfectly satisfactory, the woman believing herself cured. This may be done in a number of cases, and just as confidence is established in the mind of the practitioner, and for no reason that can be foreseen, an injection of moderate strength will set up some of the accidents I have enumerated. I believe that my personal experience with this method, over which I was at one time very enthusiastic, is not different from that of others who have given it a fair trial in any considerable number of cases, either in hospital or private practice. I know that it coincides very accurately with the results at St. Mark's, where its use has also been abandoned.

Prolapse and Invagination.

The simplest form of prolapse is that which is composed only of the mucous membrane of the rectum. It is also the form most commonly seen, and to a slight extent is often found in connection with old and large hæmorrhoids. It is said to be more frequent in women than in men, and it is the form usually seen in children.

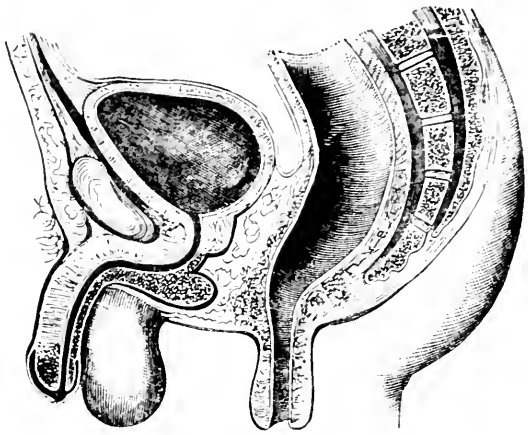
The second variety of prolapse is an exaggeration of the first. It consists not in a sliding down of the mucous membrane, but in an inversion of all the coats of the bowel, and therefore, when of sufficient extent, of the peritoneum. The first variety is shown in Fig. 83, and the second in Fig. 84. In both these varieties the protrusion begins at the part of the rectum nearest the anus. In the third variety the part of the rectum higher up is passed into and through that nearest the anus, and what is known as invagination or intussusception takes place. In the fourth variety we have the same condition as in the last, except that a portion of the gut farther away from the anus is implicated, and the invaginated portion may not appear at the anus at all. We may have, therefore, invagination with prolapsus or invagination without prolapsus.

This condition must, of necessity, cause a sulcus or groove to exist between the containing and contained portions, where the mucous membrane of the one is directly continuous with that of the other, and the

depth of this sulcus from the anus depends upon the point at which the invagination has occurred.

Such a protrusion as this is evidently composed of an entering and

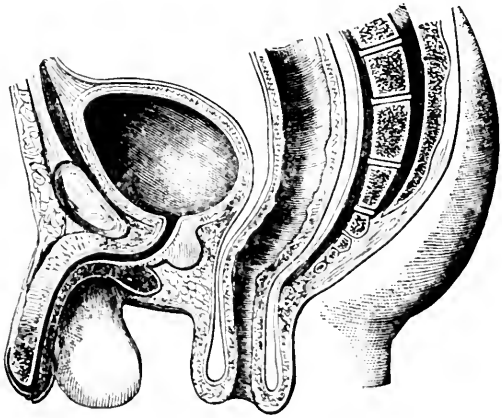
FIG. 83.



First Variety of Prolapse.

returning portion of bowel, each in its whole thickness (Fig. 85). There is the ensheathing portion, *1*; the entering portion, *3*; the returning portion, *2*; which must be carefully distinguished from

FIG. 84.



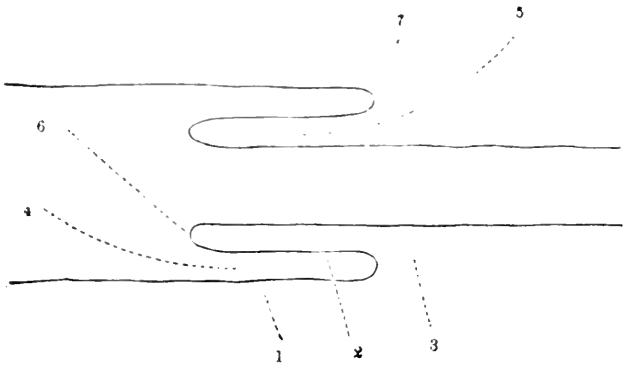
Second Variety of Prolapse.

each other. The former (*1*) is sometimes spoken of as the intussuscipiens, and the two others combined as the intussusceptum. Within the sulcus (*4*) two mucous surfaces are in contact, and without the sulcus (*5*) two serous surfaces. The point (*6*) where the entering portion

(3) becomes the returning portion (2) is known as the apex of the intussusception, and the point (7) where the returning portion joins the sheath is the neck.

The causes tending to produce a prolapse are various: First, those

FIG. 85.



Intussusception

which tend mechanically to draw down the mucous membrane in defecation, such as polypus, hæmorrhoids, vegetations, and tumors. Second, are those which produce tenesmus and muscular spasm, such as fissure, worms, proctitis, dysentery, phimosis, cystitis, calculus, and stricture of the urethra. Third, are those which tend to weaken or destroy the action of the sphincters, such as ulceration or incision or spinal paralysis.

Prolapsus of the first and second varieties generally comes on gradually, and not suddenly, though the reverse may be the case. It may be partial or complete as regards the circumference of the rectum. It is at first spontaneously reducible, or at least easily replaced by gentle pressure, and it remains reduced till the next act of defecation; but as the size of the prolapse increases the difficulty of reduction becomes greater.

Prolapsus of the first variety when slight in extent is not infrequently mistaken for hæmorrhoids at a casual examination, especially when it is confined to a portion of the circumference of the gut. With care, however, a protrusion composed of healthy or slightly eroded mucous membrane can always be distinguished from a tumor made of blood-vessels and connective tissue located beneath the mucous membrane. When the tumor is larger the diagnosis presents no difficulties.

In every prolapse of large dimensions the surgeon must be prepared to find all of the coats of the gut involved, and hence must be on the lookout for the peritoneum. From the anatomy of the peritoneum it is much more likely to be found in the anterior portion of the tumor

than in the posterior, but it may be in both. In the peritoneal pouch thus formed there may be located coils of small intestine, an ovary, or even the uterus, as will be more fully described later. As this variety of the disease only differs from the first in degree, there is no groove or sulcus, as in that next to be described, and the absence of such a groove is therefore no proof against the presence of peritoneum in the tumor.

It is a mistake to suppose that this second variety is not met with in children, although it is unquestionably more common in adults. It may be distinguished from the first generally by the touch. With one finger within the gut and the thumb outside it will generally be possible to decide whether the tumor is composed of all the walls of the bowels or of the mucous membrane alone. The form of the tumor is conical; its walls are thick and firm; when pressed between the fingers the gurgling of gas may be felt in a contained loop of small intestine, or there may be resonance on percussion, and the hernial contents may be reduced; the orifice is not round and patulous, but slit-like and drawn backward by the attachment of the meso-rectum or forward by the vagina.

A prolapse left untreated usually increases. At first it only appears on defecation; later it is down all the time. At first it is easily reducible; then a change occurs, and replacement is no longer possible. When inflammation occurs there is more or less local irritation and general constitutional disturbance. The prolapse becomes swollen, hard, and painful, and the tumor is subsequently larger and harder than before, from infiltration. The mucous membrane may at any time become eroded and ulcerated from irritation. Strangulation is rare, but may occur at any time. It may be only temporary when properly treated, or it may end in sloughing, which shall involve a part or the whole of the tumor. It may result in cure from cicatricial contraction, or in general peritonitis and death. When it involves the entire circumference of the tumor, a stricture of greater or less gravity is the necessary result. These changes are not apt to occur in the first variety of the disease, and are generally confined to the second and third.

The treatment of prolapsus of the first and second varieties may be either curative or palliative. Often the surgeon's first efforts must be directed toward effecting the reduction of the mass. In children this may generally be done by laying the little patient on its face over the knees, and making gentle pressure on the mass with greased fingers. If this cannot be accomplished without undue force and bruising of the mass, the child should at once be etherized and a radical operation performed.

In an adult, however, both ether and operation may be either

refused, or, on account of a bad general condition, contraindicated. In such a case, after gentle taxis in the knee-elbow position has been tried and failed, cold should be applied while the patient remains prone in bed with the pelvis raised by pillows, and this may be alternated with warm poultices and with plentiful applications of an ointment of opium and belladonna. When by the action of the sphincters the tumor has become oedematous, cold is especially indicated, but it must not be too long or vigorously applied, lest sloughing result. When sloughs have already appeared, the case must be left to time and charcoal poultices, and, unless the sloughing be very extensive or circular in shape, a radical cure will often result after about three weeks' rest in bed.

Before any kind of treatment except reduction is begun the surgeon must carefully seek for some exciting cause, the removal of which will effect an immediate cure. Polypus is the most frequent and efficient of these, and many a case of extensive prolapsus in children may be cured by passing the finger into the bowels and breaking off a small fleshy tumor hanging loose by a long slender stem. Worms, constipation, phimosis, and calculus should all be looked for and treated before any operation is done upon a prolapsus dependent upon their irritation.

The palliative treatment is directed toward diminishing the frequency and amount of the prolapse, and in children a cure may sometimes be effected by these means alone. The tumor may sometimes be prevented from descending during defecation by having the act performed in the standing posture, or recumbent in bed with one buttock pulled aside to tighten the anal orifice. After the bowels have moved, if the tumor has come down, it should be washed with an astringent (alum, tincture of iron, oak bark) and gently replaced, the patient being confined to the bed for a time to prevent re-descent. After the bowel has ceased to descend with defecation, an astringent injection may be given every night with advantage, and allowed to remain in all night. This should not be more than a couple of ounces.

After inflammation or partial strangulation has occurred, a cure by these simple measures is scarcely to be expected. The conditions are changed; the tumor is thickened and increased in hardness; it has become too large for its former relations in the pelvis, and is itself a cause of irritation.

There are two ways of curing a prolapse: one is the reduction in the size of the tumor or its complete removal; the other is the tightening of the anus, so that it cannot descend. In any case one or both of these methods may be attempted.

Attempts, and some of them successful in severe cases, have been made to cause a decrease in the size of the tumor by injecting certain irritating substances into the tumor itself and the surrounding cellular

tissue. The plan is one which has never acquired much popularity except in the slight cases associated with hæmorrhoids, in which, when the latter have been reduced in size by injections of carbolic acid, the prolapsus dependent upon them has also ceased to be troublesome.

The first form of prolapsus may be cured by one of the three following methods: When not too large or too much thickened, a thorough painting of the mucous membrane with strong nitric acid will generally cause just sufficient sloughing to result in a cure. The application must be made when the tumor is down. The part should first be dried of its mucus with a little cotton, and the acid then applied lightly on the end of a stick. Only enough should be put on to cause a distinct change in color, and the acid should very carefully be confined to the mucous membrane, and not applied to the skin. The application is not in itself painful. The tumor should then be greased and reduced, a pad should be placed over the anus, and the buttocks drawn together with a broad strip of adhesive plaster. The bowels should not be allowed to move for three days, and then an enema of oil should be given, and great care taken to prevent the descent of the tumor, as before indicated. It may be necessary to repeat the use of the acid a second time, but it will generally be efficient in the end. This plan is especially adapted to children, in whom there is apt to be a good sphincter.

In old people, where the sphincters have lost some of their power, and in children who have resisted this method, another plan of cauterization will be more effectual. This is known as Van Buren's treatment, and is performed as follows: With the patient under ether and the prolapse down, the smallest tip of the Paquelin cautery, heated only to a dull red, is drawn over the length of the tumor with just sufficient force to go through the mucous membrane. Five or six linear eschars should be made, very lightly at the upper portion, heavier below. The tumor should then be replaced, and the sphincter burned at two points on opposite sides with the same iron; but these cuts should be made into the substance of the muscle, so that the resulting contraction will lessen the size of the anus. After the cauterization the patient should be treated as after the application of the nitric acid.

In more severe cases still, and in cases of the second form of the disease in which there is no reason to fear the presence of peritoneum a still more radical operation may be done. This is exactly the same clamp-and-cautery operation described in speaking of hæmorrhoids, and it is equally satisfactory. It has been applied in years gone by to very large tumors containing peritoneum—tumors the size of a cocoanut—and with good results; but now we have a better way of dealing with all the cases in which, from their size, the presence of the

peritoneum is to be apprehended, as well as those old and severe ones sometimes met with which have resisted all other methods of cure.

The operation of circular amputation and suture has been applied occasionally to old cases of prolapse for some years, and within the last year or two has become quite general. It is done in several different ways, but the essential idea is the same in all. It consists in first making sure that the prolapsus contains no hernial contents, then in amputating it below the anus—first the anterior half, and then the posterior—and, finally, in carefully suturing first the serous surfaces if they are present, and secondly the other layers of the gut. I have found it an advantage to transfix the tumor after it has been well pulled down by two long needles, passed so as to cross each other through the entire thickness of the prolapsus just below the sphincters, and then to encircle the mass with an elastic ligature above the needles, which prevent it from slipping. This does not at all interfere with the operation, and effectually controls the bleeding, which is apt to be profuse when the gut is amputated. Of course the greatest care is necessary in an operation such as this to be sure that the amputated mass does not contain a loop of small intestine. The results of this method seem to be exceedingly good, and when done properly the plan is to be recommended in cases in which milder methods have failed.

The surgeon will occasionally be called to treat a case of quite extensive prolapse in which there is a circular slough, and must know what to do in such an emergency. It is not best to leave these cases to nature, for though the slough will separate and the tumor shrink up and finally become reducible, the slough will leave a circular stricture, and the lower down, nearer the apex of the prolapse, the slough is, the higher up and less amenable to subsequent treatment the stricture will be. In all such cases the operation of circular amputation and suture is to be recommended. Even should the amputation be followed by some contraction, the stricture will be low down near the sphincter, and can easily be treated by subsequent dilatation.

Every few months a case is reported in some journal of so-called "spontaneous rupture of the rectum" or of "rectal hernia," with protrusion of a mass of small intestine, and death. Almost invariably, the history begins with the statement that the patient had suffered for years from prolapse. These cases almost all come under the second class described, and are cases of rupture of weakened and inflamed prolapsus, usually either from direct violence or from straining at stool, although a weakened rectum may rupture and permit of the escape of small intestine where there has been no previous prolapsus. It is doubtful whether a healthy rectum is ever ruptured except as a result of direct injury.

In my work on *The Rectum and Anus* I have collected all of these

cases obtainable, some twelve in number, and have analyzed them. For lack of space the reader is referred to that work for a full account of the disease. Here I wish only to call attention to the treatment. Only two of these cases have recovered. One was a very early one (Nedham, 1755), in which, after the protruding mass, measuring fifty-seven inches, had become gangrenous, it was simply cut off close to the anus. The other is one in which the hernia of the small intestine followed an operation by Henry Smith on a large prolapsus with the clamp and cautery. Only a knuckle of the gut protruded, was at once reduced, and no bad symptoms followed.

The general principles which should guide in the treatment of this accident are plain, and I am anxiously waiting the report of the first fortunate case in which their adoption will be followed by a cure.

There is no doubt that the first thing to be done is to effect the reduction of the mass after it has been properly cleansed. The amount is often many feet, and it is usually distended with gas and fæces; the rent through which it must be returned into the peritoneal cavity is more or less concealed, and the gut constantly tends to pass upward into the rectum. The loops last descended should first be replaced, but the whole mass has seldom been replaced without laparotomy. After reduction the rent in the gut should be sutured if possible, and a posterior division of the gut down and past the coccyx and along the side of the sacrum may render this possible, though it will always be found a difficult undertaking. Nor do I believe it to be absolutely essential to recovery if the rectum be properly cleansed and tamponed with iodoform gauze around a rectal tube.

If the protruded gut be gangrenous, the gangrenous part must be amputated, and the choice remains between circular suture with subsequent replacement, or the formation of a rectal artificial anus by fastening the proximal extremity to the rectum at the site of the laceration. This is evidently what Nature did in her cure of Nedham's celebrated case.

In the third form of prolapsus, the form in which there is an intussusception protruding from the anus, the diagnosis is made by the presence of the sulcus, as before indicated. The depth of this sulcus will sometimes give important information, for the upper part of the rectum may be invaginated into the lower and appear at the anus, or the ileo-cæcal valve may have passed along the whole length of the large intestine and appear as a prolapsus.

It is manifestly impossible to deal here with the whole question of intussusception, but a few practical points may be brought out with advantage.

When the upper part of the rectum becomes invaginated in this-

way, the included portion will not always appear at the anus, and the diagnosis can be made only with difficulty.

The symptoms of the condition are peculiar and suggestive, and will often leave little doubt as to the diagnosis if the patient has sufficient intelligence to describe them with any accuracy. The invagination is generally not constant, or at least if it is so it causes no symptoms except in defecation. Then there is peculiar difficulty in the act. The patient strains, and the more the effort the less the result. Finally, when exhausted he gives up the effort in despair, and almost immediately there is a movement. The patient will say that when he strains the bowel becomes closed—that he can feel a tumor which it is impossible for him to evacuate. One of my patients could only relieve himself in the knee-elbow position, and another when lying down. In addition to this it may be possible to feel the tumor with the finger when the patient assumes the natural position for defecation and strains.

The treatment consists in linear cauterization high up in the rectum. This must be done carefully, and not with a Paquelin cautery, but with the old-fashioned olive-pointed actual-cautery iron heated to a black heat only. Too free cauterization here carries great risk of periproctitis.

When the invagination is confined to the rectum, reposition and reduction may be possible by taxis, by enemata, or by passing the hand into the pelvis. A soft rectal bougie passed to the bottom of the sulcus may give great assistance. Failing to accomplish this by gentle measures, combined with anæsthesia and reversed position, there is nothing remaining but immediate laparotomy.

Non-malignant Ulceration.

The many different varieties of simple ulceration of the rectum may for convenience be grouped under the following heads: 1. Traumatic; 2. Catarrhal; 3. Tubercular; 4. Dysenteric; 5. Venereal.

Any wound of the rectum or anus is liable to refuse to heal and to take on ulcerative action, even such a crack in the muco-cutaneous margin as may be caused by the passage of a large mass of fæces. This is the most frequent cause of fissure, or "irritable ulcer," as it has been called from the amount of pain it generally gives rise to. There is no profit in elevating this simple traumatism into a special class, as it differs in no essential respect from other traumatic ulcers in the same location. Fissures, however, cause in different people very different symptoms. Some cause hardly any uneasiness, and trouble the patient so little that he or she hardly cares to seek relief. Others will cause agony during and after the act of defecation, and are the source of a train of reflexes that seem to be limited to no part of the body. Nor is there anything

in the general appearance of the disease which can indicate whether it belongs to the painful or painless class, the secret of the difference probably lying in the fact that in certain cases a terminal nerve-filament is exposed in the sore.

The traumatisms caused by faecal masses are not, however, confined to fissures at the verge of the anus. Scybalous masses in the large intestine have been the direct cause of death by ulceration and perforation, as in one case of my own; and I have seen several cases of erosions and superficial ulcerations in the rectal pouch which could be accounted for in no other way than by the lodgment for a length of time of hard faecal masses in constipated people.

Another frequent cause of ulceration is the traumatism inflicted directly by the surgeon in operations. Some patients heal after an operation quickly, others slowly, others perhaps only with the greatest difficulty or not at all. No factor is so potent in determining under which class any particular case will come as that of rest. More sluggish wounds of the rectum can be cured by absolute rest and proper diet than by all other means combined. This is seen constantly in hospital and dispensary practice. The patient heals rapidly for the first week or two after an operation, and is allowed to leave his bed and resume his work, being told to report in the out-patient room. Then, not infrequently, the trouble begins, and a wound which would have healed in bed in another week is still unhealed, and in fact making no progress, at the end of many weeks.

Another frequent cause of delayed healing is improper dressing and over-medication. This is seen more often in operations for fistula than elsewhere, and is generally due to the false idea that the incisions should be packed daily. It is no uncommon sight to see granulation tissue crushed out of all health and vitality by careful, systematic, and forcible stuffing of an incision with lint.

A not infrequent form of ulceration is due to violence inflicted upon the surface of hæmorrhoids, either in the act of defecation or in replacing them after protrusion at stool; and this ulceration differs in no essential respect from varicose ulceration in other parts. The ulcers are very sluggish, very difficult to cure, and liable to extend, cause great destruction, and in the end cause stricture. This variety of traumatism is to be distinguished from that due to the injection of hæmorrhoids by any substance capable of producing a slough; and in this varicose tissue a very weak solution of any of the drugs used for this purpose is capable of doing this. The resulting ulcers are apt to be deep, the cavities have ragged edges and walls, and they may be attended by serious hæmorrhage when the slough separates, and be very slow in healing.

I have seen many severe cases of ulceration of the rectum due to

too powerful medication. Nitrate of silver, nitric acid, strong carbolic acid, etc. are drugs to be used upon the rectum by a skilful hand and with a very definite purpose in view.

Catarrhal ulceration of the rectum may be due to any of the causes capable of exciting a catarrhal proctitis, and a very slight irritation is apparently capable of doing this. In women an eroded spot is not infrequently found just where either the heavy cervix or fundus of the uterus presses upon the rectal wall. Another exciting cause of this form of ulceration is the presence of a perfectly benign polypus, which by the irritation of its mere presence will cause first a catarrhal proctitis in its neighborhood, and then an ulcer with loss of tissue. Some of these cases are very severe.

Tubercular ulceration is unfortunately not an uncommon affection of the rectum. It may most positively be diagnosticated by the discovery of the bacilli under the microscope, and yet its gross appearances are sometimes diagnostic. When associated with fistula the ulceration due to the breaking down of the tubercular deposit is the cause of the fistula, and in such cases the internal orifice of the tract will be found large, and it will be manifest that the first stage of the disease has been due to the destruction of the rectal wall, and that the burrowing has simply resulted from the breach thus made. In such cases when the finger is introduced into the rectum it will drop into a large internal orifice of a fistulous tract. The ulceration when more extensive has an unhealthy varnished appearance, secretes but little healthy pus, is not covered by granulations, and is surrounded by but little induration. The sore ends abruptly in healthy tissue.

There is no doubt that tubercular ulceration of the rectum may be a primary affection, appearing long in advance of any pulmonary deposit, though the opposite is more frequently the case.

Allied to the tubercular process, and yet almost as closely to the syphilitic, is a class of ulcers known as lupoid, which have erroneously been made into a distinct group supposed to have a special pathology, and described in many works under the title of *Esthoménc*. In general terms they are phagedenic ulcers attended by great hypertrophy of the nature of elephantiasis, and affecting primarily the skin of the verge of the anus and the vulva. They are most frequent in prostitutes, are not infrequently chronic chancroids, are sometimes simple syphilitic infiltrations, and they may result from any simple traumatism to these parts in a person with the syphilitic, tubercular, or, as we used to call it, scrofulous diathesis. The diagnostic points are their chronicity, their constant tendency to spread in all directions, causing great destruction, their almost invariable accompaniment by great hypertrophy of the adjacent parts, and their very light mortality. I have had for years a patient in New York, whom I see at intervals

either in one hospital or another or on the streets, who is the picture of health. She is a large middle-aged woman, has had the ulcer for at least ten years, is the mother of a family, and yet the recto-vaginal septum is entirely destroyed, and the clitoris and labia are one indistinguishable mass of hypertrophy.

Rodent ulcer is a variety of epithelioma sometimes, though rarely, seen at the verge of the anus, and liable to be mistaken either for true epithelioma or for syphilis. It does not, however, lead to glandular infiltration nor does it yield to syphilitic treatment. Dysenteric ulceration is by no means uncommon in certain parts of this country, and the chronic cases not infrequently find their way into our hospitals for treatment. The ulcers affect by preference the upper part of the rectum and sigmoid flexure, and vary much in size, being generally multiple. This is one great difficulty in the prognosis and treatment of these cases, for when a colotomy is done for manifest dysenteric ulceration of the rectum there is no certainty that the colon may not also be involved above the artificial anus.

The venereal ulcers of the rectum are of numerous varieties, and, though in the brief space allotted to this subject it will be necessary to write dogmatically, there is hardly any part of it which might not be elaborated into a chapter.

Speaking broadly, we will include under venereal ulcers those in any way resulting from the sexual act, and thus include the class of traumatisms due to unnatural vice. Some of these are not specific, and yet very severe ulceration with great loss of tissue may be caused in this way. They are, happily, not frequent, and yet seldom does a year go by without my seeing one or two of them, and as likely in private as in public practice. They are confined to no walk of life, though it is well to be on the watch in negroes, sailors, and prostitutes. Except in their peculiarity of origin they differ in no respect from other simple ulcerations due to traumatism, and their origin will often be confessed without much questioning, though violence is generally given as an excuse.

Proctitis due to sodomy may be either traumatic or gonorrhœal. The symptoms are pain, tenesmus, and a discharge of sero-purulent matter. In gonorrhœa the inflammation is more intense, the purulent discharge more profuse and greenish in color, but the absolute diagnosis must remain with the microscope. The disease is rare, and a severe inflammation of the rectum should not be assigned to this cause without good proof.

Chancroids at the anus are much more frequent in women than in men, because of the facility of auto-inoculation and the possibility of accidental contact and inoculation by the male organ in coition. They

may be due to unnatural intercourse, but their presence is no proof of the vice.

Chancroids may be single or multiple, may be so superficial as to resemble fissures located between the radiating folds of skin, or may become phagedenic and cause great destruction both of the skin and of the rectum itself. They have the same characteristics here as elsewhere: the base is soft, the edges sharply punched, the secretion profuse, and they tend to spontaneous cicatrization. In cases of doubtful diagnosis auto-inoculation should be relied upon for proof.

When these sores take on unhealthy ulcerative action and extend upward, destroying the mucous membrane of the rectum, there is no doubt that with cicatrization they may cause stricture of the rectum; but that this is the usual etiology of the so-called syphilitic stricture of the rectum is very doubtful.

In the rectum, as in the throat or upon the skin, we have secondary syphilitic ulceration following its usual course, only slightly amenable to antisyphilitic treatment, and ending in stricture; and to my own mind it is to this form of disease that the term "syphilitic stricture" best applies. It is not an uncommon form of stricture, and yet it has to bear the blame of many other varieties in no way due to venereal disease.

True chancre of the anus is not very rare, as any one with a large venereal clinic can testify. In women it may be due to accidental contact, while in men it means unnatural vice, there being no question of auto-inoculation. True chancre within the rectum has been several times reported as a great rarity, but how common it may be as a result of unnatural vice will never be known, as it may cause very little local annoyance.

Mucous patches about the anus are very common, and may form ulcers of considerable size, which by neglect and uncleanliness may end in destruction of the soft parts. They sometimes take on a warty, vegetative character—the true syphilitic condyloma.

The diagnosis of the presence of ulceration of the rectum is seldom difficult, though the differential diagnosis of the variety may not in all cases be possible without the microscope. The symptoms of ulceration are pain, diarrhœa, and, above all, the finding of the products of destruction of tissue in the stools. Many of the symptoms of ulceration, such as the frequent passages, the ropy mucus, and obscure pain, may be caused by an ordinary intestinal catarrh; but the presence of blood, pus, and broken-down tissue is conclusive. With the finger also a very superficial loss of tissue can be detected if the examiner be sufficiently expert, and when more serious disease exists its character can generally be decided by this means alone, though it is impossible to give to the reader a knowledge of the different sensations conveyed

by the different forms of disease. Difficulty will sometimes, however, be felt by the most expert in deciding between tubercular and syphilitic disease, or in distinguishing between commencing malignant deposit and advanced non-malignant destruction; and yet by the proper examination, under ether if necessary, and the use of the microscope, the diagnosis is always possible.

Having thus briefly enumerated the different forms of non-malignant ulceration, we come naturally to the important question of treatment, and it may be well to say in advance that the practitioner must prepare himself for much weary waiting, patience, and disappointment; for there is no class of diseases which demands more surgical skill, and which is at the same time less satisfactory to treat.

We will consider first the treatment of those varieties of ulceration in which the indications are plain and easily carried out.

In the irritable ulcer, or so-called fissure, two lines of treatment are sanctioned, either of which will in the majority of cases be successful. The older and perhaps more generally practised is paralysis of the sphincter by forcible division, and the newer and possibly neater and more surgical procedure is incision of the muscular fibres forming the floor of the ulcer. In my own practice the latter is the favorite. It is done either under ether or after injecting cocaine into the cellular tissue under the muscle, and the incision is begun in healthy mucous membrane above the disease, is ended in the skin below the disease, and is made just deep enough to cut all of the fasciculi forming the base of the sore. Entire division of the muscle is unnecessary, the idea being to give the diseased part rest by division only of the muscular fibres exposed by it. This treatment, properly carried out, seldom fails, though in the more trifling cases of erosion, cracks, and superficial ulceration a mere dressing of the spot in the proper way, an ointment, or an application with the brush will often effect a cure without use of the knife. There are many people who suffer from a slight laceration of the mucous membrane of the anus after an unusually hard and difficult stool. In such, a mere touching of the spot with a solution of nitrate of silver (10 grains to the ounce), or a dressing with a few shreds of soft sheet lint, or an ointment of white precipitate made up with cold cream, will effect a cure after two or three days. Indeed, many heal spontaneously.

In all old fissures a polypus hanging down upon the ulcerated surface, and preventing its healing by the irritation of its presence, should be looked for, and if found removed. The association of these two affections is not at all uncommon. Also in many cases a deep and rebellious fissure will be found at the base of an external hypertrophied tag of skin, seemingly produced by the direct tension of the tag upon

the part in defecation. In these cases the removal of the hypertrophy by the scissors will immediately cure the fissure.

Rodent ulcer should be removed completely by the knife, as epithelioma elsewhere should be.

Dysenteric ulceration should be treated by local applications of weak solutions of nitrate of silver (1 grain to 2 ounces), made in the form of voluminous enemata, and by the general rules applicable to all cases of ulceration of the rectum, later to be described.

Lupus, or *esthiomène*, is to be treated by destructive cauterization and by iodide of potassium and mercury where there is any suspicion of syphilitic poisoning. The only case of this disease I have ever seen in which medical treatment seemed to have any curative effect was in a child treated for a long time by mixed treatment. After one year of this medication the affection was certainly in a fair way to be entirely cured.

Chancroids of the rectum and anus must be treated by destructive cauterization with nitric acid and dressings of iodoform, and the cauterization must be so thorough and complete that no spot can escape to make a focus for fresh auto-inoculation. This can only be done properly under ether when the ulcer is not at all extensive and occupies any of the radiating folds of skin or mucous membrane.

True chancres of the anus tend to heal spontaneously, as they do in other localities. Mucous patches will heal under constitutional treatment, and the vegetating mucous patch or syphilitic condyloma should be treated both by internal medication and by destructive cauterization.

The later syphilitic ulcerations of the rectum should be treated by mixed treatment, but this should not be relied upon alone. It may do good, but it does less good here than almost anywhere else in the body; and it is always to be remembered that an ulcer of the rectum, though syphilitic in its origin, may very soon reach a stage where it cannot be cured by antisyphilitic medication.

After following these special indications in individual cases, there are some general rules to be noted which are adapted to all cases. And, first of all, it is well to understand that there is no universal panacea and no uniform line of treatment which can be relied upon for a cure. The following experience will illustrate what I mean: a simple fistula was cut by me some months since in my clinic. Several incisions were made, and all healed kindly but one. After many weeks of treatment this one was reduced to the size of the finger-nail, and there remained for four months, the patient attending to his ordinary light work and coming regularly to the clinic twice a week. The attention of the class was frequently called to the case, and all suggestions made by the gentlemen were adopted successively. It may be imagined that many dressings were used, but all with no effect. Finally, to illustrate what

I wanted—rest in bed—I brought the patient into the hospital and promised the class he should be entirely well in one week. I ordered a dressing of balsam of Peru to make sure, and the man patiently kept his bed till, at the end of the week, I showed him to the class—with absolutely no improvement. Being then at the end of my own pharmacopœia, I ordered the house physician to leave him absolutely alone for a few days, only keeping him still in bed; and at the end of four days there was firm cicatrization.

This is by no means an individual case. I have treated patients for weeks in my office with the simplest wounds, and had them get well simply by a rest in bed over a Saturday and Sunday.

This illustrates the first great law in the treatment of all ulcers and unhealed wounds of the rectum and anus—rest in bed. Not rest on a lounge after an hour spent at the toilet and three or four walks to the dining-room for meals in the course of the day; but absolute rest after the plan of Weir Mitchell. To this rest must be added a proper diet, preferably of milk, eggs, and meats. Milk alone is the best if it is well borne, but this may be added to by the things which are best absorbed in the digestive canal and leave the least irritating residue to be discharged by the rectum.

To this general physical rest and unirritating diet may be added local medication—nitrate of silver as a stimulant or caustic, strong acids for destruction and the subsequent excitement of healthy repair, iodoform, dressings of lint and balsam of Peru or red wash, injections of starch and bismuth, each with a definite idea of a certain object to be accomplished, and none blindly on general routine principles.

To the general rest of the muscles of the rectum, pelvis, and perineum obtained by the recumbent posture, more absolute local rest may be added by the use of the knife. To me the reason why many of these sores refuse to heal is to be found in the involuntary contraction of the circular muscular layer of the gut upon which they rest; and this motion is only to be overcome by a free division of these fibres with the knife. This applies as well to ulcers above the internal sphincter as to fissures.

The last means at our disposal is complete excision of the diseased surface or its destruction with acid or the actual cautery. It often happens that an old ulcer of the rectum will not heal while a fresh wound made by its complete removal and the removal of the underlying muscular tissue will heal kindly.

Tubercular ulcers, and ulcers of other varieties which have resisted all other treatment, should be submitted to this. It may seem radical to recommend a complete amputation of a couple of inches of the rectum for a chronic non-malignant ulcer, but I know of nothing else which in many cases will effect a cure, and have more than once

successfully resorted to it after months of other treatment had done no good. The tubercular ulceration may be extirpated exactly as malignant disease would be, with resulting cure.

In many of the bad cases of non-malignant ulceration which cannot be treated by excision or made to heal by local applications or by general treatment, colotomy is the only resource, and in these cases the operation shows its greatest benefits. Colotomy in malignant disease is but palliative at the best, but in non-malignant disease it is curative, and in cases incurable by other means the surgeon is not justified in withholding from the sufferer the relief it is sure to give. Moreover, in these colotomies the artificial anus should be so formed as to permit of closure by a subsequent operation. This is a promise I always hold out to these patients, and am always ready to fulfil should they desire it and the condition of the rectum indicate it; but the contrast between the former suffering and the comfort of the artificial anus invariably prevents their return to the old condition of things. I have had ladies tell me that nothing would tempt them to have the artificial anus closed; and not long since I caught three of my colotomy patients in an earnest discussion on this subject—their unanimous verdict being that they were entirely too comfortable as they were to care to take any chances of having the inguinal opening closed.

Non-Malignant Stricture.

The following table will be found to include all of the varieties of non-malignant stricture of the rectum:

Congenital.	Partial,	
	Complete.	
Acquired.	1. Spasm.	
	2. Pressure from without.	
	3. Non-venereal.	*a.* Dysenteric.
		b. Tubercular.
		c. Inflammatory.
		d. Traumatic.
	4. Venereal.	*a.* Ulceration (either chancroidal, secondary, or tertiary).
		b. Due to unnatural vice.
		c. Neoplastic (gummata, ano-rectal syphiloma).

The congenital narrowings of the rectum, both complete and partial, have been already described under the head of Malformations, and

attention has been called to the fact that the condition is sometimes shown only by the presence of obstinate constipation, till an examination late in life proves the existence of a congenital narrowing, which at the age of thirty-five or forty begins to cause all the usual symptoms of an acquired stricture.

Strictures due to pressure from outside the gut are not at all uncommon. A tumor of any kind in the pelvis, an old pelvic cellulitis in women, a cancer springing from the promontory of the sacrum, may, any of them, cause sufficient pressure to lead to intestinal obstruction.

Spasmodic stricture of the rectum is still, as spasmodic stricture of the urethra used to be, a subject of animated debate; but the whole question now rests upon clinical evidence. Have observers whose word is beyond question ever met and described a true spasmodic stricture of the rectum? Spasm of the external sphincter from any cause, such as fissure, is not included in the question.

In answer we think we may safely say that true spasmodic stricture, caused by contracture of the involuntary circular fibres of the rectum, has occasionally, though very rarely, been observed and reported by those whose dictum is worthy of all credence. Allingham upholds its existence as a phenomenon grafted upon organic stricture, and calls attention to the fact that there may be very little deposit and much spasm—a spasm which disappears after the administration of ether. Spasmodic stricture of the rectum is a thing easy to diagnosticate—one which has been exceedingly profitable to the quacks for many generations, and yet one seldom seen by men of authority. In general it will be found to rest upon the fact that the unskilful examiner does not know just how to guide a bougie beyond the promontory of the sacrum.

Nevertheless, as my own observations have multiplied I have come to have greater faith in the possible existence of this condition as a great surgical curiosity. I have never seen anything that could properly be so classified but once in many years' practice of my specialty. That case is perhaps on that account worthy of notice:

The patient was a very nervous physician, worn out with suffering from disease of the rectum, and having also cancer of the stomach. His one great symptom was pain in the rectum, caused by defecation, increased by the sitting posture, and lasting often for many hours after defecation. On touching the skin near the anus in an attempt to separate the parts, the pain was so intense as to cause him to cry out. With the utmost gentleness the finger was passed through the external sphincter, and about an inch above—or, in other words, at the upper level of the internal sphincter—it was met by a tight stricture. A few days later he was etherized—the same stricture being verified by myself and my assistant before the ether—and only after profound

narcosis did the contraction disappear. The patient was suffering from hæmorrhoids and from an erosion over the internal sphincter. The removal of the hæmorrhoids and incision of the ulcer effected a perfect cure.

Here, then, we have distinct spasmodic stricture at the level of the upper limit of the internal sphincter, associated with other disease. Does the same thing occur higher up in the rectum, and without other disease? To a certain extent I am also ready to put myself on record (as I have never done before) in the affirmative. This much I have certainly appreciated more than once. On introducing my finger into the rectum of a patient (generally hyperæsthetic) I have found it tightly grasped at a point as high as I could reach. Leaving it there for a few seconds, and gently palpating for disease or for a free opening upward, I have suddenly felt the whole canal open up and balloon out, leaving the finger in a patulous cavity. If we may have contracture to such a degree, why not more?

The non-venereal strictures are the direct sequence of the various forms of non-venereal ulceration.

Dysenteric stricture, though often denied as a result of dysenteric ulceration, is not at all uncommon. On this point I think most pathologists will agree with me. These strictures, moreover, are very apt to be extensive, are surrounded by much inflammatory deposit, strongly resemble what are usually called "syphilitic strictures," and hence are perhaps not recognized under their proper etiology.

Proctitis, acute or chronic, and periproctitis, acute or chronic, may either of them lead to sufficient thickening to produce stricture. Periproctitis, as has been mentioned, often results in great destruction of tissue, and, should the patient recover, to great subsequent deformity. The various forms of traumatism which result in stricture come under this head.

Tubercular ulceration, when it causes stricture, does so simply from inflammatory deposit and induration, and seldom from cicatricial contraction. There is not often sufficient cicatrization in tubercular disease to cause a stricture from contraction of the cicatrix.

The venereal strictures (and we wish distinctly to distinguish between the words "venereal" and "syphilitic") may be either cicatricial or neoplastic. Certain of the venereal ulcers will cause cicatricial strictures. These are the chancroids and the later syphilitic ulcerations. The true chancre and the mucous patch we leave out of consideration for lack of space for full discussion.

There is a class of venereal strictures, however, which are not primarily ulcerative, and hence not cicatricial. In this class are to be included the gummata and what has been described under a special name by Fournier as ano-rectal syphiloma, but which is in reality

apparently a form of gummata. These syphilitic deposits occlude the rectal wall by their mere presence, instead of closing it by ulceration and subsequent cicatrization.

The symptoms of stricture are almost invariably, except in cases of congenital contraction, associated with those of ulceration, and masked by them. Flattening of the fæces is a sign of doubtful importance. Spasmodic action of the external sphincter may cause typical tape-like passages, and a stricture high up in the rectum which will easily admit a No. 8 rectal bougie will do the same when the mucous membrane above is crowded down into it in the act of defecation. Ballooning of the rectum, which Bryant has recently called attention to as a sign of stricture, may be due equally to chronic constipation and loss of tone. Even the long bougie may lead to error in examination for this condition, as a stricture is often said to exist simply because the instrument fails to pass the promontory of the sacrum, and is said not to exist because the instrument passes its full length. Whereas, malignant disease may be present, and to a sufficient extent to cause fatal obstruction, even in cases in which a medium-sized bougie can be passed without its detection.

Stricture within reach of the finger can always be diagnosticated by digital examination. Nothing is more difficult than to diagnosticate with certainty the existence of stricture in the upper rectum or sigmoid flexure beyond the reach of the finger. In my own practice should I fail after repeated attempts to pass a bougie its full length of twelve inches, I should be willing to commit myself to a diagnosis of contraction of the gut; but success in passing the bougie would not lead me to say a patient had no serious disease, or even dangerous stricture, did the symptoms point to such a condition. It must always be remembered that a stricture of large calibre, one admitting a No. 8 bougie, may be fatal when located in the upper and more movable part of the rectum or in the sigmoid flexure. This is easily explained by the anatomical relations. It is often a source of wonder how a patient with almost complete closure of the lower rectum can go on for years passing small deformed masses of fæces, and yet prevent fatal obstruction. The reason lies in the fixity of the gut at this point, and in the fact that the whole muscular force of the body can be brought to bear upon the fæcal mass, which is thus driven through a very narrow passage from which the fixation of the lower rectum allows of no escape. In the sigmoid flexure and upper rectum the conditions are changed. The force of the abdominal muscles, acting upon the fæcal mass, may cause a bending of the movable gut upon itself, and merely increase the existing difficulty by adding a sharp flexure to an obstruction. For this reason a slight stricture high up is much more dangerous than a tight stricture low down.

In the diagnosis of stricture we trust to the finger, the bougie, and the whole hand in the rectum; and all of them may deceive us. Very few weeks pass that I am not called upon to differ with some brother practitioner in the diagnosis of these cases, generally, I am glad to say, in the way of doubting the existence of disease which has before been affirmed; but I never do so without freely admitting to myself the inherent difficulty of discovering the condition of a part of the gut which can neither be seen nor felt.

In the surgical treatment of non-malignant stricture we have to choose between four methods: 1. Dilatation; 2. Division; 3. Excision; 4. Colotomy.

Dilatation, either alone or subsequent to cutting, is a means of the greatest value, but it must be carried out with skill and patience. No dilatation which causes pain can be productive of anything but harm. The bougie must act not by forcible stretching, but by causing healthy absorption and resolution. When a surgeon passes a medium bougie without pain, and follows it by one of larger diameter which does cause pain and cannot be borne, he has done just so much harm, and delayed instead of expediting cure. A bougie that can be passed through a stricture, and left in for hours while the patient is asleep, does good; one that can just be forced through, and has to be immediately withdrawn, does harm. In some strictures of the anus I have begun with a small hard-rubber bougie, which was nothing more than a uterine stem, and in a few weeks have had the patient wearing a No. 8 all night unconsciously; while a little overhaste in the outset has produced fissures which delayed the treatment for weeks.

By long-continued use of the bougie after the operation of free linear division I have seen as near an approach to absolute cure of stricture as I have ever seen—much nearer than by any other method of treatment except excision. That is, I have seen absorption in great part of the induration, cessation of all blood and mucus discharges, due to healing of the attendant ulceration, daily, painless, well-formed passages, and patients considering themselves absolutely cured and reporting to me only at long intervals. Naturally, such a result requires time. It is a treatment for the rich, and not for the dispensary, and, above all, it requires intelligent perseverance on the part of the patient. For these reasons it is a plan which promises the best results in the better class of private practice.

To save time in dilatation I usually prefer to do a preliminary proctotomy, or free division of all of the stricture tissue in the posterior median line. This is an operation which by itself was at one time much vaunted by the French surgeons as an absolute cure. I have never found it so. It is analogous to an internal urethrotomy, and we all know how little that accomplishes unless followed by dilatation.

By proctotomy I mean always a complete division of the stricture, and of the anus and soft parts below it, down to the tip of the sacrum, to allow for free drainage. Division of the sphincter alone, without this provision for drainage, is a very dangerous operation, the cellular tissue of the pelvis being opened into and constantly bathed in purulent and feculent discharge.

Following Weir, I have attempted to avoid the free division of the sphincters (a wound requiring weeks to heal) by passing a drainage-tube from the bottom of the incision through the stricture, out through the skin at the tip of the coccyx. Some of these cases have done well, some have not. The free incision is the safer method.

Let me describe a case which will illustrate what can be done by a combination of these two methods. The patient was a gentleman of middle age with a very extensive non-malignant stricture, traumatic in its origin, existing for twenty years, and extending higher than the finger could reach. So extensive was it that a celebrated English specialist ten years ago declined to operate upon it, and regretted that he had not seen it before. The patient had all of the usual symptoms of the condition, and his life was becoming a burden to him with the frequent calls to stool, the constant discharges of blood and slime, and the inability to observe ordinary cleanliness of person or to enjoy the usual sociabilities of life.

He wished me to operate, and I was willing to do so. My index finger failed to reach the upper limit of the disease, even after free division of the soft parts down to and beyond the tip of the coccyx. I divided as far as I dared, momentarily expecting to open into the peritoneum through the posterior wall of the gut. Fortunately, the peritoneal reflexion was high up, and this fatal accident was avoided. The operation was not at all to my mind—in fact, I practically abandoned it without completing it—and the patient made a slow convalescence. After a couple of months I was delighted to find that all but the upper end of the stricture had been cut, and that a bougie could be made to pass through what remained.

The result, after one year of treatment, is this: The patient passes a No. 12 bougie three times weekly, and leaves it in half an hour. He has one passage daily in the morning by the aid of an enema, and has no more trouble with his bowels for the twenty-four hours. The discharge of blood and pus has so far decreased under local applications to the ulcerated surface that he has abandoned his old dressing of a large pad of absorbent cotton and a cloth, and a simple pledget of lint laid against the anus suffices to catch all discharge for six or eight hours. He is still improving, and the discharge can be still further diminished, while the calibre of the rectum can be maintained.

This is an unusually successful result, only obtainable in a man of

sufficient means to devote time to a cure. In such a case ordinarily the best treatment would be a colotomy, but I relate the case as an example of what under favorable conditions can be done by proctotomy and dilatation.

Proctotomy is not without danger of fatal periproctitis. In cases of extensive disease my own statistics tend to show that it is quite as fatal as colotomy. In such a case as the one just related the risk must be much greater in the former than in the latter.

The excision of benign stricture is one of the steps of progress in the surgery of the rectum of the last decade. When the disease is of such a character that it can be resected and the ends of the gut brought together and sutured, there is no doubt that it gives the best results possible in many cases. Personally, I have only applied it to disease of rather limited extent, covering only a couple of inches of the gut longitudinally, and where the induration was not so extensive but that a section of the rectum could be excised without encroaching to any great extent upon the pelvic circular tissue or the peritoneum. In other words, I have not carried the operation to the same extent that would seem justifiable in malignant disease, and have not taken with it the same risks of fatal results, being guided by the idea that, though perhaps not cured, these patients could be made comfortable by less serious measures, including colotomy.

Inguinal colotomy has a wide range of applicability in non-malignant disease. By it all suffering can be relieved and a life of constant annoyance changed at once to one of comparative comfort. Indeed, the operation gives much greater satisfaction here than in malignant stricture, though no greater relief; but in cancer the operation only delays the inevitable end, while in non-malignant disease it is curative.

Cancer.

About one half of all the cases of stricture of the rectum will be found to be cancerous, while the remaining half will be divided among the various classes in very different proportions. It is a popular idea in the profession that most strictures are either malignant or syphilitic, but a careful study of the non-malignant cases will reveal a smaller number than is usually imagined in which any venereal origin can be shown. It is by no means justifiable to suspect a patient of venereal disease simply because he or she is suffering from a non-malignant stricture.

A collection of over one hundred personal cases shows the relative frequency to be as follows:

Males	70
Females	59
Cancer	59

Venereal	17
Non-venereal	33
Doubtful (non-malignant)	9
Congenital	5
Due to pressure	2
Spasmodic	1

Cancer in the rectum is usually seen in one of two varieties—epithelioma or scirrhus. In epithelioma we have the characteristic ulceration with raised, hard edges, and in scirrhus the deposit of new material in masses of greater or lesser size in and around the rectal wall. Other varieties of malignant growths do occur, and occasionally it will be very difficult, either by the gross appearances or the microscope, to decide between a benign and malignant adenoma. Benign growths tend to become pedunculated and grow away from the rectal wall, hanging loose in the calibre of the gut, while malignant ones tend to infiltrate the gut itself, and increase by the deposit of new tissue around the point of origin.

The length of time the disease has existed is of great importance in the diagnosis. When a middle-aged patient says he has suffered from the usual symptoms of ulceration for a year or two, has lost flesh, and is steadily growing weaker, the suspicion of malignancy should always be aroused. When, on the other hand, a patient tells you he has had stricture for a number of years, and is not much worse now than at any time for years past, although the feel to the finger may be much the same as in the last case, the disease is not malignant.

I do not hesitate to call attention to these difficulties of diagnosis, because, though in most cases the diagnosis is easy to the experienced examiner, in others it will not be found so; and this difficulty is one readily acknowledged by most surgeons. I have seen dysenteric stricture that I should have unhesitatingly pronounced scirrhus had not the patient assured me he had suffered from it at least fifteen years.

The symptoms of cancer of the rectum differ in no way from those of non-malignant ulceration and stricture. The disease may be very insidious in its progress, and attended by slight pain and discharge, so that it may be far advanced before the patient suspects that he has anything but piles; or it may be attended by great pain almost from the commencement, and this pain may be reflected to the loins, thighs, genital organs, or any neighboring part.

Coming now to the question of treatment, we approach a subject which has been fruitful of much discussion—one in which the landmarks of former days have been entirely swept away, and in which every surgeon is still a law unto himself. My own ideas have been very conservative, and I have hesitated to adopt a radical practice which is nevertheless perfectly justifiable, as shown by the experience

of others. From the first, where the disease was easily removable I have of course removed it—cases in which the growth was circumscribed, was near the anus, and did not invade the peritoneum or adjacent organs. Cases of more extensive disease were treated in a palliative way, but colotomy, the greatest of all palliatives, I for a long time avoided, being led by an erroneous idea of the disgusting deformity which, with most others, I dreaded to inflict upon the patient.

From this last position I was soon driven by one or two cases of death from intestinal obstruction which should have been treated by an artificial anus, and in which life might have been prolonged and an easy death substituted for one of great agony. A few colotomies were sufficient to prove to me that this was our greatest resource in relieving pain and prolonging life in cases unfit for radical operation; but the next question demanding an answer was, What cases should be abandoned, so to speak, to colotomy, and in how extensive disease were we justified in giving the patient the chance of cure which a complete removal of the disease offers? Even on this point my practice has become much more radical, and I now extirpate in every case in which it seems physically possible to remove the entire growth.

On this point every surgeon will be guided in his practice by the results of his own experience. The success when obtained is brilliant and very encouraging, but failure is very depressing when we think how much longer the patient might have lived, and in what comfort, had we been content with a simple colotomy and its comparative safety of performance. Through about this course of education by experience every conscientious surgeon who sees many of these cases has to go, but meantime we have learned much.

Many of the older methods of attempted palliation have been abandoned as the advantages of colotomy have come to be accepted by the profession at large; and this applies with great force to such feeble efforts at relief as curetting; partial destruction or removal of the growth by caustics, knife, or electrolysis; dilatation; and even proctotomy.

This last operation is one from which great things were expected as a substitute for colotomy, but it has not stood the test of time for malignant stricture, though of great value in non-malignant. In malignant stricture the incision cannot be followed by effective dilatation, and it rapidly fills up, while the operation itself in my own experience has been attended by high mortality. It is, to my mind, a more serious procedure than a colotomy, its dangers arising from shock and secondary hæmorrhage, and it bears no comparison with the latter in amount of relief afforded.

In all cases of cancer of the rectum we are reduced, therefore, to one of two plans of treatment, colotomy or excision, the only question being as to proper selection of one or the other.

Colotomy is applicable to all cases. It can never be contraindicated where the patient is not already too far gone for its probable safe performance. It is an operation attended by little danger and sure to give relief, to prolong life by allaying pain, and to retard the growth by removing the greatest of all sources of irritation. Never have I performed the operation and had reason to regret doing so from failure to obtain the expected relief; and in a few cases in my earlier practice I now greatly regret not having done so.

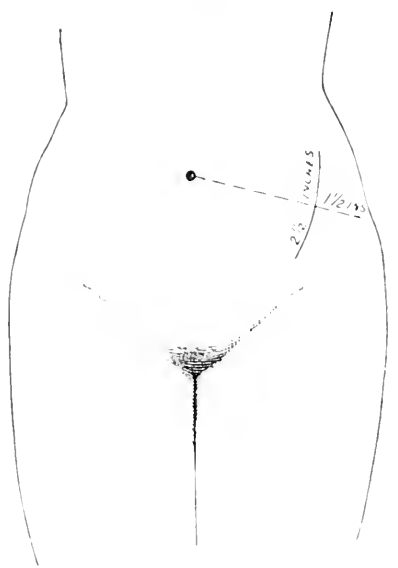
As to the choice of operation, inguinal or lumbar, I greatly prefer the former. There has been much recent discussion on this point, and within a year Bryant, the father of the lumbar incision, has once more said all that can be said in its favor, but without changing the prevailing tendency amongst the surgeons of to-day in favor of the inguinal operation. The one argument he advances which is unanswerable is that in cases of great abdominal distension from intestinal obstruction the lumbar operation is the easier of performance; and this is true, for the very distension which may add great difficulties to the inguinal incision is an assistance in the lumbar by forcing the desired coil of gut out of the incision made to reach it. Granting that this is true, and that the seat of the obstruction is known to be below the point of the lumbar incision, the operation in the loin may be chosen in those cases with advantage. In all other cases the advantages will be found to apply to the operation in the groin. The operation here is easier of performance, the artificial anus is directly within the sight of the patient for cleanliness and dressing, and, above all other reasons, the opening in the gut is much better adapted for subsequent closure if desired. Again, the opening in the gut may be adapted at will to the particular end in view. If it be made as a preliminary to a subsequent resection of the rectum, or if it be done for a curable non-malignant ulceration with the idea of subsequent closure, it can be so made as to admit of closure by a simple plastic operation without resection and suture. If it be intended as a permanency, it can at will be made so that no fæcal matter shall ever again pass into the segment of gut beyond the opening. That this is a matter of no slight moment is shown by Bryant's statement that in only three-fourths of his lumbar operations has he succeeded in accomplishing the great end of the operation—the prevention of the passage of fæces over the diseased surface.

The line of incision for inguinal colotomy is shown in Fig. 86. A skilful operator will have no difficulty in cutting down upon the peritoneum and exposing it to the full extent of the cutaneous incision without using a director, which takes so much valuable time. When the peritoneum has been exposed, any spouting vessels in the wound should be secured before the abdomen is opened. After the peritoneum has been seized with dissecting-forceps and snipped, it is

best divided with a pair of straight blunt-pointed scissors; and as it is incised an assistant should follow the incision and seize the free ends of the membrane at half a dozen points with dressing-forceps, which are left hanging in the wound. These save much time lost in searching for the free edge of the peritoneum during the subsequent suturing.

The large gut must next be found. It may, and often does, present in the incision. It is recognized by the strongly-marked longitudinal bands of muscular fibre, by the thickness of its walls, and by the *appendices epiploicæ*. Error, and serious error, may occur at this point unless the operator is familiar with the look and feel of the large bowel as distinguished from the small. A longitudinal band may be made to appear quite plainly in the small gut by a little tension which gathers the normal longitudinal muscular layer into a band. There is never any excuse, however, for mistaking one for the other.

FIG. 86.



Incision for Inguinal Colotomy.

If the sigmoid flexure does not present in the incision, a finger passed down to the brim of the pelvis will usually at once bring it to light. Should it fail to do so, the finger may be passed from the outer border of the incision along the abdominal wall down into the iliac fossa, and the gut met in this way. Usually, to a cool and deliberate operator there is little difficulty, but there may be much; and there is nothing to do but to find the gut by gentle searching.

I have seen some awkward pauses just at this stage of the operation, and I myself always feel a little relieved when the gut with its well-marked characteristics comes to the light, for, as I have often explained when operating in public, no man knows exactly beforehand what he will find when he has opened the abdomen for a colotomy. In one case we found the gut bound down to a uterine fibroid by strong adhesions, and were obliged to open the colon much higher up, where another coil presented. Great variations I have also found to exist in the mesentery of the sigmoid flexure. In one of my cases there was no mesentery to the lower part of the flexure. It was bound firmly to the iliac fossa, and, though I could pass a finger under it, I could not

raise it into the wound to fasten it. Fortunately, the upper part of the sigmoid was free.

I relate these difficulties simply that the operator may be prepared for them, and need not be unduly overcome by them. Usually, the gut will be found with slight difficulty, and the operation may be proceeded with as follows: My own operation differs somewhat in its next step from that of others, in that a silver-wire suture is passed entirely under the gut to secure it in its position, and also to secure an effectual spur. Formerly I used a hare-lip pin for this purpose, but a properly arranged silver wire, with shot-and-shield fastenings, is preferable, because more easily introduced. The suture is passed as follows: One end of a silver wire twelve inches long is arranged with the perforated shot and shield, and the other threaded to a suitable needle. The needle is passed through the entire thickness of the abdominal wall one inch to the right of the incision, then through the mesentery of the gut, and out through the entire thickness of the abdominal wall on the other side of the incision, far enough away from the wound, so that the shield when adjusted shall not impinge upon the gut when fastened in position. The wire is then drawn more or less tightly according to the kind of spur it is desired to form, the needle is cut loose, the shield slipped on the wire down to the skin, the shot after it, and clamped with strong forceps.

The object of this wire suture should be thoroughly understood. In the first place, we know there will be no tearing of the gut away from the wound while it remains in position—an accident which has happened more than once in coughing or vomiting when the ordinary sutures of silk have been the only ones used. Again, this wire can by more or less tension be made to form any flexure in the gut desirable, and any sort of spur. Drawn tightly, the operator can produce by it an absolute obstruction. Now, a spur should be more or less extensive according as the operation is intended to be absolute and final or only provisional. In provisional artificial anus the less spur consistent with complete emptying of the bowel through the artificial anus the better, for the opening is the more readily closed by a simple plastic operation covering it over, and resection of the ends with subsequent suture, which is a much more serious operation, may be avoided. On the other hand, in permanent artificial anus where there is no probability of ever attempting to close the opening, the more marked the spur the better will the fæces be directed out at the artificial channel.

Another point in passing this suture is to introduce it not across the middle of the cutaneous incision, but on the level of the junction of the middle and lower thirds. By so doing, when the outer wall of the gut is cut away two openings are left—the upper, larger one above the spur, allowing for the free escape of fæces, the lower, smaller one below

the spur, allowing for washing out of the distal portion of the gut, but not being free enough to allow even fluid faeces to get into it and pass down to irritate the diseased part.

The next step in the operation is the suturing, and here, again, operators differ. The stitches are so passed as to unite the serous surface of the gut to the serous surface of the abdominal wall, and at the same time to fasten the gut to the skin. In other words, each suture includes the skin of the margin of the incision, the cut edge of the parietal peritoneum, and the serous and muscular layer of the gut. The sutures should not perforate the cavity of the gut. Six or eight of these stitches are sufficient to give apposition of the two serous surfaces, with the wire suture to prevent displacement. But it is evident that the sutures may be so passed as to fasten almost the entire calibre of the intestine outside of the abdominal cavity, and above the level of the skin, by introducing them into the wall of the gut close down to the mesenteric attachment; or, on the other hand, that the free edge of the gut may be fastened to the skin incision in such a way as to leave almost all of the intestinal loop below the level of the incision.

In some cases it is well to follow one plan, and in others the opposite will best give the required result; and in this adaptability of the sigmoid flexure lies one of the great advantages of the inguinal over the lumbar operation. In a general way, the rule is this: If a permanent opening is made for incurable disease, the wire suture should be tight, and the silk stitches should be passed deep down by the mesenteric attachment to draw the calibre of the intestine well out of the abdomen. If, on the other hand, the opening is intended as provisional only, the wire suture is not drawn as tight (may even be omitted altogether), and the silk sutures should be inserted farther away from the mesenteric attachment.

In suturing additional firmness may nearly always be gained by passing the stitches through one of the longitudinal bands. Occasionally two of them can be utilized in this way, but generally only one will be available.

There are but few cases in which the obstruction is so great as to render an immediate opening of the gut necessary, and in them it can be done with perfect safety if proper care be taken to get accurate apposition of the serous surfaces. Even a few hours' delay, however, is an advantage, in that it allows of closing the peritoneal cavity by plastic exudation. This exudation is very free, and should be provided for by a dressing of protective next to the skin to keep the other dressings from touching the parts. Unless there is a decided call for haste in opening the gut, I usually leave the first dressing undisturbed for forty-eight hours. The gut is then incised without ether by puncturing it with a sharp bistoury, and then cutting away the superfluous gut

with scissors. Here, once more, the operator must be guided by the circumstances. In provisional artificial anus as little of the wall of the gut should be sacrificed as possible, and the operator should be content with a mere longitudinal incision into the wall. In other cases the free edges of the gut may be trimmed off to within a quarter of an inch of the skin. The silver wire may be removed by the end of the third or fourth day, and the silk sutures a few days later. The bowels may move through the artificial anus immediately after the gut is opened, or it may be a week before any fæces escape.

After the operation I always provide the patient with a well-fitting truss with hard-rubber pad, to be worn over the artificial anus during the day.

One's experiences with this operation are always full of interest, for, though manually perhaps not a difficult one, it is the unexpected that always happens, and which the operator must be prepared to meet. I have found the sigmoid flexure so diseased that it was impossible to open it, and have had to use the transverse colon instead. This case gave no support to Bryant's argument that the lumbar incision is better—that the opening is farther away from the cancer of the rectum—because the descending colon could not have been opened at any point. The difference in location between the lumbar and iliac openings is not as great as is imagined. When the gut is pulled well down into the inguinal incision, the artificial anus can be made within two and a half or three inches of the spot opened by the lumbar operation. Cases of course may arise in which the additional distance would be important, but they seldom do, as the operation in the majority of cases is for disease of the rectum and not of the sigmoid flexure.

I have seen the gut fastened into the inguinal incision in the reverse position, so that when the opening was made the fæces were evacuated from the lower angle of the wound, and the upper was the distal portion of the gut. Such reversing of the gut may easily happen, especially after a considerable search has to be made for the sigmoid flexure and it is drawn some distance from its natural bed to fasten it into the wound; but I do not know that any harm results from it.

With the exception of these minor difficulties I have never encountered any accidents in the operation of colotomy. Two or three times in cases of obstruction there has been considerable evisceration, but I have never had to resort to incision for relief of the distension. A short mesentery may at any time render the operation more difficult than it would otherwise be, but I have seen only one case in which some part of the descending colon or sigmoid could not be brought to the surface with ease. In that case the entire mesentery was so infiltrated with cancer that it was with great difficulty that any piece of gut, small or large, was found healthy enough to form a new anus with.

The subsequent condition of patients with artificial anus is worthy of note. I know of no single point upon which public and professional opinion generally is more at variance with the truth than this. The prevailing idea, that the lives of these patients must be miserable, that they are loathsome objects, suffering from a continual flow of feces from the groin, is to any one with experience in these cases simply laughable. The comfort of an artificial anus necessarily depends much upon the skill with which it is made, as has been clearly shown in the description of the operation. It is an easy thing to open the sigmoid flexure, but the kind of opening depends very much upon the operator, and the patient's comfort much upon the kind of opening. A certain amount of prolapse of the mucous membrane is the most frequent cause of after-annoyance, and this cannot perhaps be avoided in every case; but it is a self-reducing prolapse when the patient lies down, and it can be kept in by a properly-fitting truss. As to passages, there is little discomfort when the feces are solid. Usually, after a few weeks, the bowels acquire the habit of a single daily evacuation, and this is preceded by a sufficient warning. Occasionally, as in the normal condition, there will be an evacuation both night and morning; and one patient writes me that her bowels move only every second or third day, and sometimes only after a laxative.

In a general way, then, I can only say that my patients are happy in the relief afforded by the operation, and do not suffer either mentally or physically from the deformity. In cases in which the opening has been made for non-malignant ulceration, which has been cured by the operation, I have sometimes been quite anxious to close the artificial anus and restore the parts to their normal condition, but so far none of my patients have been willing to take the chance of a return to the old state.

Not long since I operated upon a poor little emaciated woman with cancer of the rectum, whose sufferings had driven her to attempt suicide by taking Paris green. The attempt was a failure, and I did a colotomy, extirpation being out of the question. At the time of the operation she was spending most of her days and nights upon the water-closet. Four weeks later she walked into my clinic, smiling and happy, suffering no pain, and yet with a marked increase in the amount of the disease, which was rapidly involving the mesenteric glands and the external organs of generation. Ten weeks after the operation she had gained eight pounds. She was steadily approaching the end, but considered herself on the road to recovery. This is what colotomy will do, and there is nothing else known to science that will do as much.

Regarding the dangers of the operation itself, a word should be said. The mortality may be either high or low in any man's table of

operations, depending on himself. Cripps gives 41 cases and 1 death; Bryant in 140 cases 50 per cent. mortality. My own are greater than Cripps's, less than Bryant's. Cripps selects his cases carefully—from the figures one would be inclined to suspect too carefully. It would not be at all difficult for Bryant, or even myself, to select 40 cases and operate without a death, but if the operation be done on the cases in which it is indicated as they present themselves, the death-rate will be higher. I myself have operated only a few hours before death because I believed it a duty to give the patient the chance, hopeless as it was.

In any case, however, the danger of the operation can be very closely estimated beforehand. I often say, "Gentlemen, the risk of this operation is scarcely 1 per cent."; or, again, "This patient may survive the operation but a few hours." The high mortality in the old cases of chronic intestinal obstruction, and the risks directly arising from the operation itself, where the gut is sound and the patient has any reserved strength, are very slight.

With this means of certain relief in our power, therefore, is it to be wondered at that certain surgeons hesitate to operate directly for the removal of the cancerous growth when we consider the mortality of that operation and the discouraging nature of the statistics as to immediate recurrence? And yet a removal of a cancer is much more to be desired than any mere palliation. There is no doubt that the statistics of extirpation are on the whole bad, but in some cases a return has been delayed six, eight, or nine years—in other words, a practical cure has been achieved. Colotomy can never do this.

This brings us face to face with the question, In what cases are we justified in balancing the risk of a fatal operation against the chance of radical cure, such as it is? and, In what cases should we be content with the certain relief and prolongation of life to be had from colotomy? It is a question on which even national schools of surgery differ in their teaching and practice. The English are very conservative. Where the disease is within easy reach, and can be entirely removed by dissecting upward from the perineum, they agree with all the rest of the world that it should be removed. In all other cases they practise colotomy. The Germans, on the other hand, set no limit to the operation except involvement of adjacent organs, and, beginning the dissection from above, remove the entire rectum and anus. Their mortality is high, but their results are brilliant in some cases, and they have certainly proven the surgical possibility of removing much more extensive disease than was ever done before the teachings of Kraske.

The Germans also have brought into practice an entirely new operation—the resection of cancer high up in the rectum, exactly as cancer of the gut elsewhere may be resected, and the ends joined by

circular suture, thus bringing within the scope of operation a class of cases hitherto abandoned as hopeless or else colotomized and left to their course.

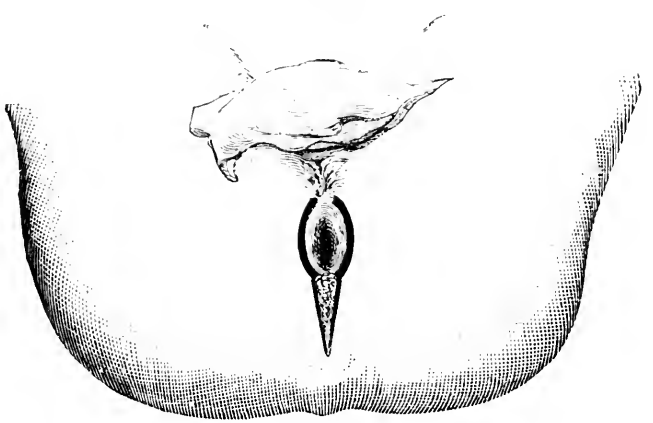
As to my own practice, I can only say that from being very conservative it is becoming more radical. The whole rectum can be removed, and when successfully done much more has been accomplished than results from a colotomy. Of course a life is sometimes shortened which might have been prolonged by a colotomy, but, on the other hand, a success in entirely removing extensive disease encourages one to renewed attempts.

In amputating the lower end of the rectum in cases where the finger can reach above the disease, the operation I prefer is the one marked out in a general way by Allingham, Jr. It certainly possesses some advantages over the other methods I have tried, and is performed in the following manner:

The patient is placed in the lithotomy position, held so by Clover's crutch, and the buttocks are elevated upon a round hard pillow. The rectum is thoroughly irrigated with bichloride solution 1 : 2500, a Sims's bivalve speculum being introduced to permit the escape of the fluid.

Taking first a case in which the growth involves the skin of the anus, the knife (a long, straight, sharp-pointed bistoury) is entered in the skin between the anus and coccyx, and passed directly upward

FIG. 87.



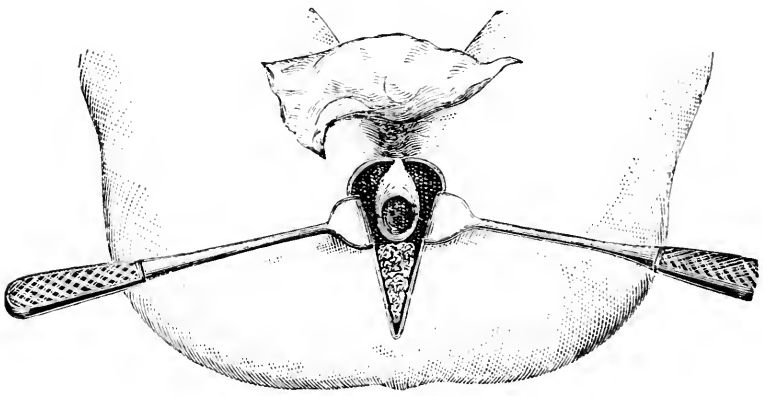
Primary Incisions for Extirpation of Rectum.

behind the gut and parallel with it, the index finger of the left hand being in the gut for a guide. When the end of the blade has passed beyond the limit of the disease, the handle is depressed and an incision

is made in the median line behind from the point of puncture down to and somewhat past the tip of the coccyx.

Two semicircular incisions are next made with the knife which completely surround the anus, as shown in the cut (Fig. 87). These should also be deep, reaching well into the fat of each ischio-rectal fossa, and not merely through the skin. The knife is then abandoned, and with a pair of long-handled, straight, blunt-pointed scissors these semicircular incisions are rapidly, by bold cuts, deepened till they pass the upper limit of the growth by at least half an inch, as shown in the cut (Fig. 88). Finally, the rectum is stripped from its attachments

FIG. 88.



Second Stage in Extirpation.

anteriorly with scissors and finger, care being taken to avoid wounding the deep urethra and neck of the bladder. Having thus circumscribed the anus and gut to a limit well above the disease, it is seized with forceps, drawn down, and amputated.

There are two ways of performing this part of the operation: One is to tie each vessel as it is cut; the other, to proceed as rapidly as possible, making deep incisions with the scissors, and trusting the control of the bleeding to an assistant, who rapidly packs the incision with sponges as the operator works his way upward into the pelvis. In either case the operation will necessarily be a bloody one, but the latter method is the one I prefer, as being in the end the least bloody of the two. Often after the pressure has been continued a few minutes, and the gut has been cut across, the upper end being held by forceps to prevent its retraction, but few spouting vessels will be found to tie, the bleeding having been at first in great part venous, and ceasing under the strong pressure exercised by the assistant.

After all bleeding has been stopped the upper end of the gut should be drawn down to the skin and loosely stitched there by a few sutures.

If much tension is required to hold it in this position, it will certainly tear out in three or four days, and in such cases it is best not to try to bring it down entirely to the surface, but simply to approximate it as nearly as possible. A drainage-tube is then passed into each fossa alongside of the gut, and the wound packed lightly with iodoform gauze not too heavily loaded with iodoform, for poisoning with the drug may easily occur.

When the disease does not involve the skin of the anus the operation may be modified somewhat to save the sphincters. The dorsal incision is then made, not behind the rectum, but through the anus up to the lower limit of the disease. The semicircular incisions are then begun within the gut and surround it—cut it across, in fact—half an inch below the level of the growth. The dissection is then continued as in the former case, and after excision of the mass the upper end is brought down and stitched to the sphincters as closely as may be without too much tension.

This, it is evident, is really an excision of the gut, and not an amputation, and it may leave the patient with a certain amount of sphincteric control.

In any case, the peritoneum may be opened in reaching the upper limit of the growth. It sometimes is reflected from the gut anteriorly at a distance of several inches from the perineum, and again it will be found within an inch and a half of the skin. The opening of the serous membrane is no contraindication to the operation. When it has been opened it is better to close it with catgut sutures, before stuffing the wound with gauze if possible, but even when the opening is merely plugged with the gauze the incision into the peritoneal cavity seems to add little to the mortality of the operation. Of course, should the gut tear loose from its attachments to the perineum and the bowels move, fæcal matter might be extravasated directly into the peritoneal cavity, with an immediately fatal result. This is best avoided by a preliminary colotomy and by free purgation, with milk diet and opium after the operation, by careful suturing of the peritoneum, and by drawing the end of the gut down to the perineum and binding it there. Faecal extravasation is, however, one of the chief causes of death after extirpation.

This operation, with slight modifications to suit individual ideas, was the limit of our resources in dealing with cancer of the rectum till Kraske a few years ago conceived the idea of attacking these growths by means of an incision into the pelvis by the side of the sacrum. His first idea was that by this method of operation growths heretofore considered as inoperable might be reached, and all that part of the upper rectum above the limit of rectal digital examination, and below the reach of pelvic colectomy, might be brought into the field of operative

surgery. The operation has been extended, however, to cover not only resection of a portion of the rectum high up, with subsequent circular suture, but amputation of the entire rectum with the anus.

The operation consists in making a median incision from the second sacral vertebra to the anus; severing the left gluteus maximus from its sacral attachments; excising the coccyx; detaching the sacral attachments of the tubero-sacral and spinoso-sacral ligaments; and chiselling away the lateral mass of the sacrum in a curved line from the outer border of the third sacral foramen to the corner of the sacrum. The anus being next freed by a circular incision, the rectum is detached from its bed; the peritoneal cavity is also opened by a circular cut, the gut is drawn well down and amputated above the tumor, and its end fixed by sutures to the para-anal tissues. The operation is completed by passing a drainage-tube into the peritoneal cavity and plugging the rectum and wound with iodoform gauze.

The serious objection to this procedure lies in the non-closure of the peritoneal cavity, whereby death results from fæcal extravasation. To overcome this Schede, after following the preliminary steps described by Kraske, substituted the following modifications: In the first case he attached the free edge of the divided peritoneum to the serous surface of the gut, thereby closing the peritoneal cavity, and then sutured the upper and lower ends of the gut with a double row of circular sutures. The wound was dressed with iodoform gauze, and opium given to control the bowels. The operation was only unsatisfactory in the failure to get union of the sutured ends, and hence in the formation of a fæcal fistula.

The great value of closing the cavity of the peritoneum is shown in two of Kraske's operations in which it was omitted, although complete union of the divided ends of the bowel was attempted. In both instances the stitches gave way during a stool which occurred a few hours after the operation in spite of every precaution to prevent it, and death ensued from peritonitis due to fæcal extravasation.

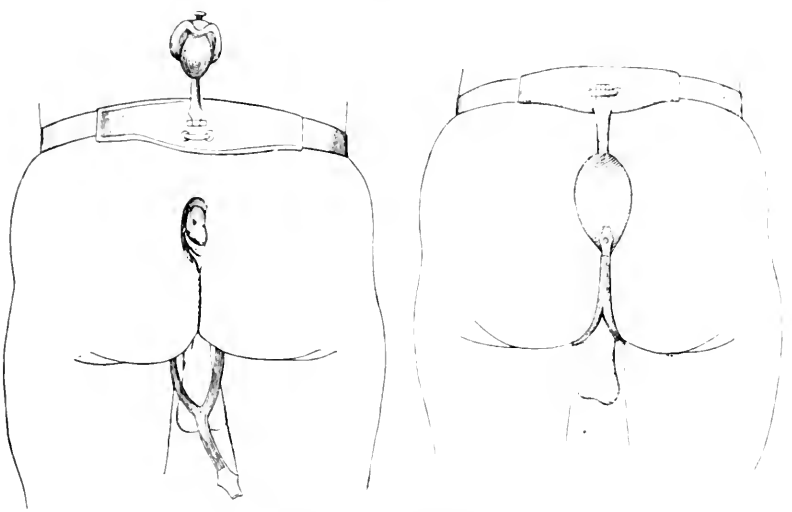
Schede, to avoid the fæcal fistula and protracted healing which occurred in his first case, modified the operation by doing a preliminary inguinal colotomy. In the first of these cases four-fifths of the rectal wound healed by first intention, and the balance by granulation; while in the second the wound had closed in two months and a half. The inguinal artificial anus was then closed by a plastic operation.

Bardenheuer extended the scope of the operation to cover certain bad cases of recto-vaginal and rectal fistulæ not amenable to other plans of operation. He performs the operation by dividing the sacrum transversely at the level of the third sacral vertebra, allowing the entire hand to be introduced into the pelvis. The left index finger is next introduced into the rectum, and the tumor pressed backward against

the dorsal incision, which is then continued till the posterior wall of the rectum is exposed in the wound. Both index fingers are next passed into the wound, and the tissues separated from the gut on all sides. A loop having been passed under the isolated portion of the gut, it is drawn out of the wound, and the tumor is separated from its bed in the same manner—first on its posterior, and then on its anterior, aspect—while in many cases the peritoneum can be stripped off without opening. Should, however, this cavity be opened, it is plugged with thymol gauze, and the operation completed by dividing the gut above and below the disease. The ends are then sutured and the wound plugged with iodoform gauze.

In certain cases in which, from the amount of rectum removed, it is impossible to unite the ends by suture, or where from the tightness of the stricture it has been impossible to empty the rectum above of fæces, or where the wound has been soiled by the same during the operation, Kraske postpones the suturing of the ends of the gut to a subsequent period; and forms a provisional sacral artificial anus at the upper angle of the dorsal incision. Hochenegg has devised the truss shown in the cut (Fig. 89) for these cases. Schede accomplishes the same

FIG. 89.



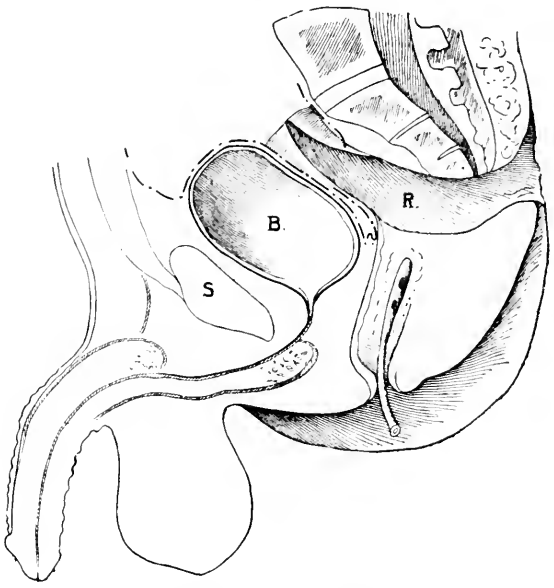
Truss used after Kraske's Operation.

end by a colotomy in the groin after the operation, and a subsequent closing of the inguinal artificial anus by a plastic operation.

Statistics of these operations are of little value, varying as they do with the skill of different operators and the cases selected for operation. Suffice it to say that the ratio of mortality is steadily decreasing with a constantly improving technique.

Hochenegg, in his last report of his own cases and those gathered from others, gives the following results of Kraske's method as distinguished from Bardenheuer's, which he considers essentially different. Out of 39 cases there were 31 recoveries and 8 deaths. Of primary

FIG. 99.



Permanent Sacral Artificial Anus.

circular suture there were 9 cases, with 3 completely successful results, 1 of partial healing, and 5 fatal. 14 cases were treated by formation of a permanent sacral artificial anus, with 12 recoveries. The mortality in all was 20 per cent.

Bardenheuer's statistics are better than these, and he believes that it can eventually be reduced to 5 per cent., except for complications, such as opening the bladder.

Von Bergmann prefers the operation to colotomy, and quotes Bramann's statistics—27 cases and 1 death.

The operation of excision is also applicable to cancer of the sigmoid flexure and colon which can be reached by an abdominal incision. Kendal Franks has collected 51 cases, from which he has drawn the following general conclusions: The operation rarely effects a radical cure. As a palliative measure it is justifiable and frequently demanded. Recurrence generally takes place in the liver or mesenteric glands, and gives an easier death. The mortality of the operation, with immediate suture of the gut and with the formation of an artificial anus, is about the same, and therefore immediate suture is to be preferred to the for-

mation of an artificial anus. The death-rate has been reduced in the later cases, and a still further reduction is to be expected.

Bryant expressed himself as against the operation. In malignant disease of the lower bowel we have to choose between colotomy, colectomy, and simply tiding the patient down hill, and he thinks the conclusion is in favor of colotomy, which gives comfort to the patient, prolongs life, and gives all the benefit colectomy can give. On looking over the tables it appeared that only 1 of the 51 cases had been cured; there were direct failures in 40, and indirect failures in 10 others. The operation was therefore dangerous and not to be recommended.

Treves speaks to the same effect. In only one case of the series presented was there no recurrence after four years, and cases of cancer which had been colotomized very commonly lived three or four years. In six years he had not seen a case in which he would have considered removing the colon for malignant disease.

Closure of Artificial Anus.

Mention has so frequently been made of the closure of a provisional artificial anus that a few words regarding the technique will not be out of place.

As I tried to bring out very strongly in describing the operation of colotomy, a provisional anus should be made very differently from a permanent one. The spur should not be as sharp, the gut should not be drawn as far out of the abdomen when it is stitched to the skin, and as little as possible of the wall of the gut should be pared away when it is incised. If these rules are followed in the original operation, it will generally be possible to close the opening without having to destroy the spur, and the operation is thus changed from a serious one to one of trifling gravity

In a case in which there is not sufficient flexure of the wall of the gut to make the removal of the spur thus formed necessary, the opening may be closed by one of two plastic operations. The simplest consists in paring the free edges of the mucous membrane, loosening them from the edges of the wound as far as possible without opening the peritoneum, and suturing them with a continuous suture, turning the free edges either into the lumen of the gut or out of it as the operator prefers. The muscular and peritoneal layers are next to be treated in exactly the same way, and finally the muscular layer of the abdominal wall is freshened and united by deep catgut sutures, and the skin closed.

It is manifest that in freshening the edges of the intestinal wall preparatory to suturing them several centimetres of tissue will be lost, and that this will be increased by the line of suture. This operation

can therefore seldom be applicable without previous allowance for this loss of calibre by destruction of the opposite angle of the gut by the enterotome.

Szymanowski's operation, on the other hand, has the advantage of closing the opening by a flap of integument, without any sacrifice of the intestinal wall. The cuts (Figs. 91–94) illustrate it very well. A

Fig. 91.

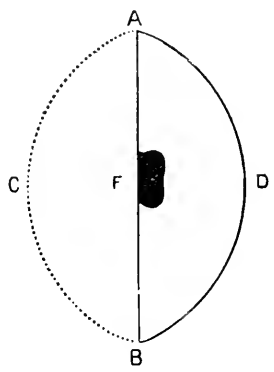


Fig. 92.

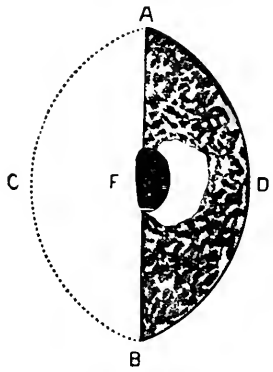


Fig. 93.

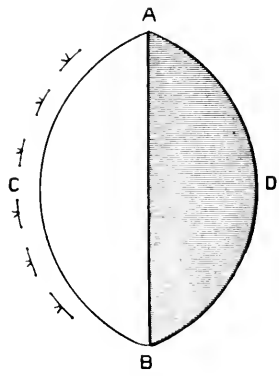
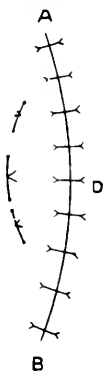


Fig. 94.



Szymanowski's Operation for Fistula (McBurney).

single straight incision is made from A, three-quarters of an inch in front of, to B, three-quarters of an inch behind the fistula (Fig. 91). This incision passes through skin and superficial fascia, and closely skirts the left edge of the fistula. The edge of this incision is raised, and, working toward the patient's left side with a small blade, the skin and fascia are undermined until a pocket is formed, including the area A, C, B, F, the left edge of this pocket being indicated by the dotted line A, C, B. On the opposite side the curved incision A, D, B is then made, the greatest width of the flap thus marked out being from three-quar-

ters of an inch to an inch. This flap should be generous, and include a good padding of fascia, as, after lifting, the shrinkage is great.

Before lifting this flap a thin layer of skin is removed from its surface. This is best done with small curved scissors, the superficial layer of skin being rapidly snipped off. The freshening process is carefully extended over the entire area A, D, B, F, excepting over a surface a little larger than the fistula and immediately next to it. The flap A, D, B is then dissected up close to the median line and inverted, its attached edge acting as a hinge and as a medium for blood-supply. Five or six fine catgut sutures are passed through the skin at different points a little beyond the dotted lines A, C, B into the pocket, then through the free edge of the flap, and then back into the pocket and out through the skin. Five or six loops are thus formed, by drawing upon which the flap is closely drawn down to the bottom of the pocket, and the free ends of the loops are tied (Fig. 94). Two or three sutures of catgut are now passed with a curved needle through the upper surface of the inverted flap, so as to bind it firmly to the parts beneath. Either with a continuous or an interrupted suture of catgut the free edge A, F, B is finally securely fastened to the edge A, D, B.

Neither of these methods involves opening of the peritoneum, and there is therefore no mortality attendant upon them. When the enterotome is used to destroy the spur, the operation is more serious. Dupuytren's statistics covered 41 cases, 3 of which were fatal. More recent statistics by Pollason give the following results: In 95 cases, 60 complete cures; 26 cases of persistence of the fistula; and 9 deaths, 4 of them directly attributable to the operation.

In some cases a cure may not be possible without a free dissection of the ends of the gut and an anastomosis, though this applies much more frequently to fæcal fistulæ than to artificial anus. In such cases the operator must choose between the different methods now in vogue—lateral anastomosis with rings, end-to-end suture with rings, or simple circular suture without rings. The latter procedure seems at the moment of writing the most to be preferred, from its simplicity and ease of performance. The old elaborate suturing formerly in vogue in this operation has been practically abandoned, and an operation which previously required hours of suturing is now done by an average operator with equally good results in twenty minutes or half an hour.

One point of importance in the formation of provisional artificial anus must be borne in mind. The distal extremity of the gut tends to very rapid contraction and atrophy from want of use, and a difference in size of the proximal and distal ends may result in a few weeks, which will make an end-to-end suture almost impossible. This may be prevented and the calibre of the distal portion preserved by daily injec-

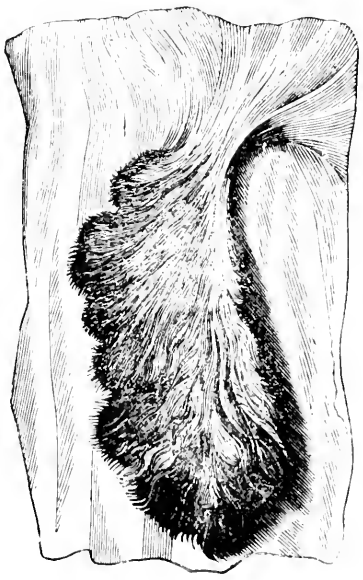
tions of milk through the artificial anus, and daily enemata of water from below.

Benign Tumors.

Under this head are included polypus, vegetations, condylomata, fibromata, lipomata, enchondromata, and the various forms of cysts, congenital or otherwise.

Polypus occurs in several different forms. The soft variety is similar to that found in the nose, and is composed only of the elements of the mucous membrane; the hard variety contains fibrous tissue. The soft polypus is made up in great measure of hypertrophied villi; the substance is homogeneous, and the fluid pressed from it contains many cylindrical epithelial cells; the tumor is often not larger than a pigeon's egg, but has been known to reach the size of an orange. This form of growth is shown in Fig. 95. The glandular or adenomatous polypi

Fig. 95.



Soft Polypus.

Fig. 96.

Hard Polypus

are well shown in Fig. 96. These may be due either to hypertrophy of the closed follicles or the follicles of Lieberkuhn. They occur most often in the young, are generally the size of a plum, but may reach that of a small pear, and have been known to weigh four pounds. They are vascular, smooth, or mammillated, and are attached by a pedicle of greater or less strength and length. When the pedicle is absent and these tumors grow in the substance of the rectal wall, instead of away from it into the cavity of the gut, they approach to

malignancy, and some are both microscopically and clinically difficult to distinguish from malignant adenomata.

These adenomatous polypi may be multiple, may cover a considerable extent of surface, and may also be recurrent. These cases are rare, and the recurrence may be the only sign of malignancy, the tumors reappearing with the same benign characteristics many times.

The hard fibrous polypus (sarcomatous polypus) is composed primarily of the elements of the submucous connective tissue, chiefly of fibrous tissue resembling the uterine fibroid, but may contain both muscular and glandular elements. When the glandular element contains fluid resembling glue, these tumors have been described as colloid, and when fluid with a jelly-like substance, they have been spoken of as myxomata.

There are also other forms of benign polypi which are difficult to classify—tumors of more or less density and vascularity, disseminated or single, such as have been described as granular papillomata, villous tumors, and peculiar bleeding tumors.

Polypus is confined to no age. It may exist from childhood and cause no symptoms till adult age. It may act merely as a foreign body, being extruded at stool when the pedicle is long enough, and occasionally bleeding when the surface has become eroded. On the other hand, it may set up much surrounding trouble. Some of the worst cases of bleeding and erosion of the rectum, with tenesmus, pain, and mucous discharge, I have ever seen—cases in which from the history a diagnosis of malignant disease seemed evident—have been due to the presence of one or two small polypoid growths high up in the rectum, not larger than the end of the index finger; and scraping off these tumors with the finger-nail has at once put an end to all symptoms.

The treatment of polypus is a simple matter, and consists solely in removal. When there is a pedicle it should be tied to prevent possible hæmorrhage. When there is no pedicle, the tumor may be curetted off, either with the sharp spoon or the finger-nail. In the multiple and recurrent variety it is perhaps well not to be too radical in treatment. When the tumors have attained considerable size and bleed a good deal, they may be broken off with dressing-forceps and the end of the finger, but the application of acids or the cautery to the surface from which they spring is seldom effectual in preventing recurrence, and in one of my cases seemed to be followed by a decided increase in the gravity of the affection.

The perineum is a favorite site for warts or papillomata composed of an hypertrophy of the papillary layer of the skin. They owe their origin to a special predisposition in certain people and to any irritation affecting this part. Thus the discharge of gonorrhœa or leucorrhœa

may cause them to grow, and yet they may appear in persons of perfectly cleanly habits. Pregnancy has an undoubted influence on their causation, and in such cases they may disappear spontaneously after delivery. Under any of these influences little tumors like ordinary warts may appear and rapidly multiply. When the wart is isolated, it is dry; when several are united, they become macerated in the secretion of the part; the tumor becomes moist and fœtid, and all the adjacent surfaces become irritated. According to the size of the growths, the condition of the patient, the abundance of the secretions, and the irritation to which they owe their origin, the growths take on various shapes, and have been described as cockscombs, cauliflower excrescences, etc. They may occur at any age, and may vary in size from a single enlarged papilla to a mass filling the perineal region and weighing a pound. They were formerly considered as proof positive of syphilis, and even of sodomy, but they are distinctly non-syphilitic, and must not be confounded with true condylomata or the vegetating mucous patch, although rare cases have been reported in which the two have existed together, the wart being caused by the irritation of the raised mucous patch.

The best method of treatment is to cut the warts down to the surface of the skin with scissors, although they may be induced to dry and shrink up by applications of astringent powders.

The other forms of benign growths, fibromata, cysts, etc., are so rare as scarcely to require special description here.

Pruritus.

Itching at the anus is an exceedingly common, painful, and annoying symptom, either of some local disease of the parts or of a constitutional condition.

The itching is more or less constant, but is particularly apt to be worse after the sufferer goes to bed at night. This is so frequent a symptom that many explanations have been suggested for it, the real one being probably found in the change in the circulation which occurs immediately after the patient assumes the recumbent posture.

The disease is sometimes attended by changes in the appearance of the parts. The skin is thickened and parchment-like, or else eczematous and moist from exudation. There may be a characteristic loss of the natural pigment of the part. The exudation may be very profuse, though the itching is but slight, and may deceive the examiner into the belief that it comes from within the rectum and is due to fistula or ulceration.

Pruritus is often dependent upon internal hæmorrhoids, and many otherwise incurable cases may be cured by an operation upon the piles. It is sometimes a complication of fistula with an external opening, or

of any ulcerative process the discharge of which keeps up an irritation of the skin. It may be dependent upon pin-worms, and in every case these should be carefully watched for. Instead of a parasite within the rectum, the itching may be due to the presence of pediculi. In such case the diagnosis and cure are alike easy. Or the parasite may be vegetable instead of animal, and the itching may be due to the disease known as *eczema marginatum*. In this case the microscope may be necessary for the diagnosis, but not often. Such cases are easily cured by any of the parasiticidal preparations, such as sulphurous acid, iodine, or mercury.

Pruritus is perhaps most frequently a symptom of chronic eczema of the parts, and thus must be treated here exactly as elsewhere in the body—first, by general, and second, by local, measures. The congestion and thickening of the skin may be reduced by applications of strong tincture of green soap, or by nitrate of silver in varying strength according to the amount of infiltration. Very hot water will be found of benefit, applied for ten minutes three times a day, and followed by an ointment to soften the skin and allay the itching. A good ointment is oxide of zinc made soft and applied gently. Chloroform ointment is an old favorite, made in the strength of 1 drachm to the ounce. Another application which is efficient is made of carbolic acid ½ ounce, glycerin 1 ounce, and water 3 ounces. This may be used at night. A solution of the liquori plumbi subacetatis in milk (1 part to 7), applied on a pledget of cotton, will sometimes secure a night's rest. Allingham uses the following:

Liq. carbonis detergens (Wright's),	
Glycerinæ,	āā. ℥j;
Pulv. zinci oxidi,	
Cretæ præp.,	āā. ʒss;
Pulv. sulph. præcip.,	ʒss;
Aquæ,	ad ℥vj.—M.

The parts to be thickly painted over with this once or twice a day, and allowed to dry.

Two other skin diseases, herpes and erythema, may each be attended by a good deal of itching, and in both the application of powders, such as zinc or bismuth, will act better than salves or lotions.

These are the most palpable, and perhaps the commonest, causes of pruritus, but there are many cases in which the cause is not easily discoverable, because it is a constitutional, and not a local, one. The most careful supervision must always be exercised over the general health. If constipation exists, it must be remedied; if the liver be torpid, it must be stimulated. Alcohol in excess is always bad. The

condition seems sometimes to be a pure neurosis, and must be treated accordingly. Smoking and coffee in such persons may have an undoubted bad effect. Finally, the symptom may be inexplicable except upon the basis of the gouty diathesis, which of course must be treated.

In this way, then, the cure of a case of pruritus must be undertaken, and I know of no disease of the rectum or anus better calculated to test the ingenuity and general medical skill of the practitioner.

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